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Langley Research Center

Scientific and Technical Information Program Office

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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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- Domestic and foreign dissertations and theses.

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

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

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Subject Divisions

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

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F. Life Sciences
G. Mathematical and Computer Sciences
H. Physics
I. Social 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

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01 Aeronautics (General)

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.*

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.*

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 Radar.*

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*.

06 Aircraft Instrumentation

Includes cockpit and cabin display devices; and flight instruments. For related information, see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

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*.

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*.

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).*

Subject Categories of the Division B. Astronautics

Select a category to view the collection of records cited. If the link is broken, there are no records to view.

12 Astronautics (General)

For extraterrestrial exploration, see *91 Lunar and Planetary Exploration*.

13 Astrodynamics

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

14 Ground Support Systems and Facilities (Space)

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

15 Launch Vehicles and Space Vehicles

Includes boosters; operating problems of launch/space vehicle systems; and reusable vehicles. For related information, see also *20 Spacecraft Propulsion and Power.*

16 Space Transportation

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*.

17 Space Communications, Spacecraft Communications, Command and Tracking

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

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*.

19 Spacecraft Instrumentation

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

20 Spacecraft Propulsion and Power

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

Subject Categories of the Division C. Chemistry and Materials

Select a category to view the collection of records cited. If the link is broken, there are no records to view.

23 Chemistry and Materials (General)

24 Composite Materials

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

25 Inorganic and Physical Chemistry

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry. For related information see also *77 Thermodynamics and Statistical Physics*.

26 Metallic Materials

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

27 Nonmetallic Materials

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

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*.

29 Materials Processing

Includes space-based development of products and processes for commercial application. For biological materials see *55 Space Biology.*

Subject Categories of the Division D. Engineering

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31 Engineering (General)

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

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*.

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*.

34 Fluid Mechanics and Heat Transfer

Includes boundary layers; hydrodynamics; fluidics; mass transfer and ablation cooling. For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

35 Instrumentation and Photography

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

36 Lasers and Masers

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

37 Mechanical Engineering

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

38 Quality Assurance and Reliability

Includes product sampling procedures and techniques; and quality control.

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*.

Subject Categories of the Division E. Geosciences

Select a category to view the collection of records cited. If the link is broken, there are no records to view.

42 Geosciences (General)

43 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.*

44 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*.

45 Environment Pollution

Includes atmospheric, noise, thermal, and water pollution.

46 Geophysics

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism. For space radiation see *93 Space Radiation*.

47 Meteorology and Climatology

Includes weather forecasting and modification.

48 Oceanography

Includes biological, dynamic, and physical oceanography; and marine resources. For related information see also *43 Earth Resources and Remote Sensing*.

Subject Categories of the Division F. Life Sciences

Select a category to view the collection of records cited. If the link is broken, there are no records to view.

51 Life Sciences (General)

52 Aerospace Medicine

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

53 Behavioral Sciences

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

54 Man/System Technology and Life Support

Includes human engineering; biotechnology; and space suits and protective clothing. For related information see also *16 Space Transportation.*

55 Space Biology

Includes exobiology; planetary biology; and extraterrestrial life.

Subject Categories of the Division G. Mathematical and Computer Sciences

Select a category to view the collection of records cited. If the link is broken, there are no records to view.

59 Mathematical and Computer Sciences (General)

60 Computer Operations and Hardware

Includes hardware for computer graphics, firmware, and data processing. For components see *33 Electronics and Electrical Engineering*.

61 Computer Programming and Software

Includes computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM.

62 Computer Systems

Includes computer networks and special application computer systems.

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.*

64 Numerical Analysis

Includes iteration, difference equations, and numerical approximation.

65 Statistics and Probability

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

66 Systems Analysis

Includes mathematical modeling; network analysis; and operations research.

67 Theoretical Mathematics

Includes topology and number theory.

Subject Categories of the Division H. Physics

Select a category to view the collection of records cited. If the link is broken, there are no records to view.

70 Physics (General)

For precision time and time interval (PTTI) see *35 Instrumentation and Photography;* for geophysics, astrophysics or solar physics see *46 Geophysics, 90 Astrophysics,* or *92 Solar Physics*.

71 Acoustics

Includes sound generation, transmission, and attenuation. For noise pollution see *45 Environment Pollution.*

72 Atomic and Molecular Physics

Includes atomic structure, electron properties, and molecular spectra.

73 Nuclear and High-Energy Physics

Includes elementary and nuclear particles; and reactor theory. For space radiation see *93 Space Radiation.*

74 Optics

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

75 Plasma Physics

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

76 Solid-State Physics

Includes superconductivity. For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

77 Thermodynamics and Statistical Physics

Includes quantum mechanics; theoretical physics; and Bose and Fermi statistics. For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

Subject Categories of the Division I. Social Sciences

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80 Social Sciences (General)

Includes educational matters.

81 Administration and Management

Includes management planning and research.

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*.

83 Economics and Cost Analysis

Includes cost effectiveness studies.

84 Law, Political Science and Space Policy

Includes NASA appropriation hearings; aviation law; space law and policy; international law; international cooperation; and patent policy.

85 Urban Technology and Transportation

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation. For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

Subject Categories of the Division J. Space Sciences

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88 Space Sciences (General)

89 Astronomy

Includes radio, gamma-ray, and infrared astronomy; and astrometry.

90 Astrophysics

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust. For related information see also *75 Plasma Physics*.

91 Lunar and Planetary Exploration

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

92 Solar Physics

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

93 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.*

Subject Categories of the Division K. General

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99 General

Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs.

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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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1. Document ID Number; Corporate Source
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SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

A Biweekly Publication of the National Aeronautics and Space Administration

VOLUME 37, APRIL 12, 1999

01
AERONAUTICS (GENERAL)

19990025458 NASA Langley Research Center, Hampton, VA USA
Aeronautical Engineering: A Continuing Bibliography with Indexes, Supplement 396
Mar. 19, 1999; 53p; In English
Report No.(s): NASA/SP-1999-7037/SUPPL396; NAS 1.21:7037/SUPPL396; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This supplemental issue of Aeronautical Engineering, A Continuing Bibliography with Indexes (NASA/SP-1999-7037) lists reports, articles, and other documents recently announced in the NASA STI Database. The coverage includes documents on the engineering and theoretical aspects of design, construction, evaluation, testing, operation, and performance of aircraft (including aircraft engines) and associated components, equipment, and systems. It also includes research and development in aerodynamics, aeronautics, and ground support equipment for aeronautical vehicles. Each entry in the publication consists of a standard bibliographic citation accompanied, in most cases, by an abstract. Two indexes-subject and author are included after the abstract section. CASI

Bibliographies; Aerodynamics; Aeronautical Engineering; Indexes (Documentation)

19990026308 University Aviation Association, Auburn, AL USA
Collegiate Aviation Review *Final Report*
Lehrer, Henry R., Editor, Nebraska Univ., USA; Carstenson, Larry, Editor, Nebraska Univ., USA; Carney, Thomas Q., Editor, Purdue Univ., USA; Barker, Ballard M., Editor, Florida Inst. of Tech., USA; Bowen, Brent D., Editor, Nebraska Univ., USA; Chubb, Gerald P., Editor, Ohio State Univ., USA; Envick, Robert M., University of Central Washington, USA; Green, Mavis F., Editor, Illinois Univ. at Urbana-Champaign, USA; Harraf, Abe, Editor, Embry-Riddle Aeronautical Univ., USA; Luedtke, Jacqueline, Editor, Utah State Univ., USA; NewMyer, David A., Editor, University of Southern Illinois, USA; Northam, Gary J., Editor, Saint Louis Univ., USA; September 1997; 57p; In English; 1997 Fall Education, 1997, Unknown; See also 19990026309 through 19990026313
Report No.(s): Rept-1997; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The colllegiate Aviation Review is published annually by the University Aviation Association and is distributed to the members of the association. Papers published in this volume were selected from submissions which were subjected to a peer blind review process and were presented at the 1997 Fall Education Conference of the Association. Contents include the following: An examination of the US policy regarding child restraint systems. Advanced qualification training: a study of implementation of CRM into airline training. The theory of functionalism and the international civil aviation organization (ICAO): an analytical assessment after the first fifty years. Student performance in the technology-enhanced aviation meteorology course. Educational requirements for a career in airline management: an industry perspective.
Author

Policies; Occupation; Qualifications; Airline Operations

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.

19990025326 Institute of Theoretical and Applied Mechanics, Novosibirsk, Russia
International Conference on the Methods of Aerophysical Research 1998 "ICMAR 1998", Part 3, Proceedings
Jan. 1998; 308p; In English
Contract(s)/Grant(s): F61775-98-WE002
Report No.(s): AD-A359009; EOARD-CSP-98-1025; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche

The Final Proceedings for International Conference on Methods of Aerophysical Research (ICMAR 1998), 29 June 1998 - 3 July 1998. This is an interdisciplinary conference. Topics include: Problems of Modeling at sub/trans/super/hypersonic velocities; Methods of flow diagnostics; Instrumentation for aerophysical experiments; Verification of CFD models and methods.
DTIC
Conferences; Computational Fluid Dynamics; Atmospheric Physics; Gas Dynamics; Supersonic Combustion Ramjet Engines

19990025485 Royal Aeronautical Society, London UK
Third Test and Evaluation International Aerospace Forum: the Management and Technology Trends of Ranges and Facilities into the 21st Century
Jun. 24, 1998; 131p; In English; Conference proceedings for Test and Evaluation International Aerospace Forum (3rd), 23 Jun 98.
Report No.(s): AD-A358857; EOARD-CSP-98-1013; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The Final Proceedings for Third Test and Evaluation International Aerospace Forum, 23 June 1998 - 25 June 1998. What do we need to test, and what facilities do we have? Management changes of test facilities; Technical changes of test facilities; Future test technology needs; Test technology solutions for the 21st Century.
DTIC
Conferences; Management Systems; Technology Assessment; Ranges (Facilities); Test Facilities; Aerospace Systems

19990025632 Wallace (Lane E.), USA
The Whitcomb Area Rule: NACA Aerodynamics Research and Innovation, Chapter 5
Wallace, Lane E., Wallace (Lane E.), USA; From Engineering Science to Big Science: The NACA and NASA Collier Trophy Research Project Winners; 1998, pp. 135-148; In English; ISBN 0-16-049640-3; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The breaking of the "sound barrier" gave an impetus to the designing of the next generation aircraft that could operate at supersonic speeds. But preliminary tests of models indicated that even the best designs put forth by industry engineers were not going to achieve that goal. A sharp increase in drag at speeds approaching Mach One was proving too much for the limited power jet engines to overcome. The solution to this impasse was found by Richard T. Whitcomb who developed the "area rule". This revolutionized how engineers looked at high-speed drag and impacted the design of virtually every transonic and supersonic aircraft built.
CASI
Acoustic Velocity; Aerodynamics; Supersonic Speed; Transonic Speed; Supersonic Drag

19990026159 Army Aviation and Missile Command, Aeroflightdynamics Directorate, Hampton, VA USA
Aerodynamic Flow Field Measurements for Automotive Systems
Hepner, Timothy E., Army Aviation and Missile Command, USA; January 1999; 190p; In English; Original contains color illustrations
Contract(s)/Grant(s): RTOP 522-31-61-01
Report No.(s): NASA/TM-1999-208965; L-17793; NAS 1.15:208965; AFDD/TR-99-A-002; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

The design of a modern automotive air handling system is a complex task. The system is required to bring the interior of the vehicle to a comfortable level in as short a time as possible. A goal of the automotive industry is to predict the interior climate of an automobile using advanced computational fluid dynamic (CFD) methods. The development of these advanced prediction tools will enable better selection of engine and accessory components. The goal of this investigation was to predict methods used by the automotive industry. To accomplish this task three separate experiments were performed. The first was a laboratory setup

where laser velocimeter (LV) flow field measurements were made in the heating and air conditioning unit of a Ford Windstar. The second involved flow field measurements in the engine compartment of a Ford Explorer, with the engine running idle. The third mapped the flow field exiting the center dashboard panel vent inside the Explorer, while the circulating fan operated at 14 volts. All three experiments utilized full-coincidence three-component LV systems. This enabled the mean and fluctuating velocities to be measured along with the Reynolds stress terms.
Author
Aerodynamic Characteristics; Air Conditioning Equipment; Automobiles; Computational Fluid Dynamics; Flow Distribution; Reynolds Stress; Flow Visualization; Velocity Measurement; Flow Measurement

19990026197 Naval Postgraduate School, Monterey, CA USA
Computational Investigation of Subsonic Torsional Airfoil Flutter
Kakkavas, Constantinos; Dec. 1998; 110p; In English
Report No.(s): AD-A359731; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

In this thesis single-degree-of-freedom torsional airfoil flutter is investigated using an incompressible potential flow code, a compressible inviscid Euler code and a compressible viscous Navier-Stokes code. It is found that the classical linearized incompressible and compressible flow theories yield unconservative flutter estimates. The computations based on the non-linear codes show for NACA 0006, NACA 0009, NACA 0012 and NACA 0015 airfoils, that the regions of torsional flutter instability increase as the airfoil thickness and the flight Mach number is increased. On the other hand, the comparison of the flutter boundaries computed with the viscous Navier-Stokes code versus the inviscid Euler code shows that the effect of viscosity is stabilizing. Also, the computed flutter boundaries display the effect of pitch axis location on flutter. Axis locations in the range between half a chord upstream of the leading edge of the airfoil and the leading edge are most prone to induce flutter. Axis locations downstream of the quarter chord are flutter free.
DTIC
Airfoils; Compressible Flow; Inviscid Flow; Incompressible Flow; Airfoil Profiles; Euler Equations of Motion; Navier-Stokes Equation; Subsonic Flutter; Potential Flow

19990026234 Office National d'Etudes et de Recherches Aerospatiales, Paris, France
Pressure sensitive paints: Application in wind tunnels ***Peintures Sensibles a la Pression: Application en Soufflerie Aerodynamique***
Mebarki, Youssef, Office National d'Etudes et de Recherches Aerospatiales, France; 1998; ISSN 0078-3780; 290p; In French; Original contains color illustrations
Report No.(s): ONERA-NT-1998-6; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

Pressure Sensitive Paint (PSP) is a recent technology based on oxygen quenching of organic luminescence. This technique, applied on aerodynamic testing, allows the measurement of pressure distribution over the model surface. The objective of this study, carried out at the Aerodynamics Department of ONERA, is the definition and the application of a PSP system in the field of steady aerodynamics. The parameters involved in the PSP technique have been analysed and the main sources of errors have been described: temperature and illumination variations. The research of luminescent compounds has resulted in a set of two original sensors. The first one, based on pyrene, is nearly insensitive to temperature fluctuations on the model, while the second one is a mixture of Temperature (TSP) and Pressure Sensitive Paint (PSP): it allows the measurement of pressure and temperature. A general approach has lead to a description of the point behaviour, which takes into account different wind tunnel test conditions (i.e. pressure and temperature). Tests in transonic wind tunnels were carried out under different flow conditions and various data processing: in-situ calibration, measurements without pressure taps and local pressure and temperature measurements using the PSP-TSP point. The application in a hypersonic facility is introduced using the pyrene-based paint.
Author
Atmospheric Temperature; Pressure Distribution; Pressure Measurement; Wind Tunnels; Wind Tunnel Tests; Paints

19990026294 Toledo Univ., Dept. of Mechanical, Industrial and Manufacturing Engineering, OH USA
Aeroelastic Stability and Response of Rotating Structures ***Final Report, 8 Jan. 1996 - 30 Nov. 1997***
Keith, Theo G., Jr., Toledo Univ., USA; Reddy, T. S. R., Toledo Univ., USA; December 1998; 3p; In English
Contract(s)/Grant(s): NCC3-446; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A summary of the work performed from 1996 to 1997 is presented. More details can be found in the cited references. This grant led to the development of aeroelastic analyses methods for predicting flutter and forced response in fans, compressors, and turbines using computational
Author
Aeroelasticity; Stability Augmentation; Rotation

19990026445 Air Force Test Pilot School, Edwards AFB, CA USA
Change in Range Factor as a Result of an Application of an Aviation Polish to a T-38A Aircraft (HAVE SLICKER) ***Final Report, 16 Mar. - 9 Apr. 1998***
Tavares, Ernest S., Jr.; Fitz, Eric P.; Kligman, Jeffery T.; Elledge, Alan; Keat, Neo H.; Nov. 1998; 72p; In English
Contract(s)/Grant(s): Proj-M96J
Report No.(s): AD-A360054; AFFTC-TR-98-05; AFFTC-TR-98-05; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report presents the results of an evaluation of a change in range factor as a result of an application of Racer's Edge polish to a T-38A aircraft (HAVE SLICKER). The objective of this effort was to characterize potential range factor (true airspeed multiplied by aircraft gross weight divided by fuel flow) changes as a result of the polish application. Testing was conducted by the USAF Test Pilot School Class 97B at Edwards AFB, California, from 16 March to 9 April 1998. Testing was requested by the Air Force Flight Test Center Single Face to Customer Office, at Edwards AFB, and was conducted under a Cooperative Research and Development Agreement number CR980100.
DTIC
Flight Tests; Aircraft Engines; T-38 Aircraft

19990026613 Innovative Scientific Solutions, Inc., Beavercreek, OH USA
Development of Filtered Rayleigh Scattering Velocimetry for Wind Tunnel Application ***Final Report, 14 Apr. 1997 - 13 Jan. 1998***
Carter, C. D.; Feb. 1998; 22p; In English
Contract(s)/Grant(s): F33615-97-C-3004; AF Proj. 3005
Report No.(s): AD-A359849; AFRL-VA-WP-TR-1998-3092; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The goal of this SBIR program was to develop a FRS (filtered Rayleigh scattering) velocimetry instrument for the study of unsteady flow fields. During Phase I we constructed a single-velocity-component device for use with a single-mode Q-switched Nd:YAG laser. This ERS device included a custom wavemeter for recording accurately the laser wavelength on each pulse, two 16-bit, back-illuminated CCD cameras, and custom Windows-95 software for integrating the wavemeter and cameras. Initially, we tested and debugged the FRS system using a supersonic (Mach 1. 36) axisymmetric jet. These tests demonstrated that accurate mean (within 5%) and instantaneous (within 4%) velocities can be obtained with this technique. Subsequent to these tests, we implemented the FRS velocimetry instrument in the SARL (Subsonic Aerodynamic Research Laboratory) wind tunnel to test the feasibility of applying this advanced instrumentation in a realistic large-scale tunnel facility. We investigated the flow over a delta-wing model with and without tail fins; here, the freestream velocity compared well to the value derived from pitot probes, while FRS measurements over the delta wing provided new insight into complex, unsteady flows. Potential applications include the timely and cost-efficient testing of novel aerodynamic concepts and designs in large-scale wind tunnels.
DTIC
Rayleigh Scattering; Velocity Measurement; Subsonic Wind Tunnels; Unsteady Flow; Free Flow; Laser Applications

19990026618 Air Force Research Lab., Air Vehicles Directorate, Wright-Patterson AFB, OH USA
Characterization of the Flowfield Near a Wrap-Around Fin at Supersonic Speeds ***Final Report, 1 Oct. 1995 - 1 Mar. 1997***
Tilmann, Carl P.; Feb. 1998; 147p; In English
Contract(s)/Grant(s): Proj-2404
Report No.(s): AD-A359861; AFRL-VA-WP-TR-1998-3058; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

A wall-mounted semi-cylindrical model fitted with a single wrap-around in (WAF) has been investigated numerically and experimentally, with the objective of characterizing the mean and turbulent flowfield near a WAF in a supersonic flowfield. Numerical and experimental results are used to determine the nature of the flowfield and quantify the effects of fin curvature on the character of the flow near WAFs. This research has been motivated by the need to identify possible sources of a high-speed rolling moment reversal observed in sub-scale flight tests. Detailed mean flow and turbulence measurements were obtained in the AFIT Mach 3 wind tunnel using conventional probes and cross-wire hot-film anemometry at a series of stations upstream of and aft of the fin shock/boundary layer interaction. Hot-film anemometry results showed the turbulence intensity and Reynolds

shear stress in the fuselage boundary layer to be far greater on the concave side of the fin than on the convex side. Mean flow was also obtained in the AFIT Mach 5 wind tunnel using conventional pressure probes. Numerical results were also obtained at the test conditions employing the algebraic eddy viscosity model of Baldwin and Lomax. Correlation with experimental data suggests that the calculations have captured the flow physics involved in this complicated flowfield. The calculations, corroborated by experimental results, indicate that a vortex exists in the fin/body juncture region on the convex side of the fin. This feature is not captured by the oft-used inviscid methods, and can greatly influence the pressure loading on the fin near the root.
DTIC
Cylindrical Bodies; Flow Distribution; Flow Measurement; Hypersonic Speed; Inviscid Flow; Turbulent Flow; Wind Tunnel Models; Fins; Wind Tunnel Tests

19990026643 NASA Goddard Space Flight Center, Greenbelt, MD USA
Two-D Representation of Three-D Modeling of Atmospheric Effects of Aircraft ***Final Report***
1999; 4p; In English
Contract(s)/Grant(s): NAG5-2739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
Our principal accomplishments during the period of this research grant were as follows: (1) development of 2-D Transport Coefficients from a 3-D GCM; (2) comparison of various 2-D Treatments of Temperature; Asymmetries for Use in 2-D Models; (3) development and Testing of Convective Flux Formulation from a GCM for Use in a 2-D Model; and (4) investigation of Bromine Balance in the Upper Troposphere and Lower Stratosphere.
Derived from text
Two Dimensional Models; Atmospheric Effects; Research; Two Dimensional Bodies; Performance Tests; Aerospace Vehicles; Flux (Rate)

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.

19990025474 Naval Postgraduate School, Monterey, CA USA
Contract Logistics Support (CLS) in the Twenty First Century: A Comparative Analysis of CLS in the T-45 Program Using NAMP/4790 Procedures Vice Commercial Best Practices
Haberthur, Michael T.; Dec. 1998; 72p; In English
Report No.(s): AD-A359115; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
This thesis evaluates the current USA Navy (USN) Contract Logistics Support (CLS) arrangement on the T-45TS program and compares it to commercial best practices. The objective was accomplished by evaluating the existing system and using technical functional and operational analyses to determine the feasibility of improving USN practice in contract methodology and language for future CLS implementations in general and on the T-45TS program in particular. Using archival research, interviews, and site visits, this study identifies the current system and state of the art commercial best practices in service contracts and contracting/quality control oversight applicable to USN CLS implementation. Broad findings include: competitively bidding a contract without owning the engineering data rights may be costly in the long run; that infusion of best commercial practices and international quality standards vice strict compliance with government practices provides an opportunity to decrease life cycle costs through reduced oversight and state of the art management techniques and processes. Further findings and recommendations on specifically improving the T-45TS program are included in the areas of; Improving Contract Practices, Personnel Qualifications, and Training.
DTIC
Human Factors Engineering; Personnel; Management Methods; Functional Analysis; Personnel Development

19990025635 Prologue Group, Redwood City, CA USA
Lew Rodert, Epistemological Liaison, and Thermal De-Icing at Ames, Chapter 2
Bugos, Glenn E., Prologue Group, USA; From Engineering Science to Big Science: The NACA and NASA Collier Trophy Research Project Winners; 1998, pp. 29-58; In English; ISBN 0-16-049640-3; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
A paradox in aircraft icing research took the National Advisory Committee for Aeronautics (NACA) further into actual aircraft design than it had ever before ventured. to gather data on new de-icing equipment under natural icing conditions, and do so

safely, NACA needed an aircraft already vulnerable to the dangers of icing. So Lewis A. Rodert, leader of NACA icing research from 1936 to 1945, built his own de-icing system on two aircraft-first a small Lockheed 12A and next a Curtiss C-46 transport that would become flying laboratories for further research. When Rodert received his Collier Trophy in December 1947, the practicality of his innovation had hardly been established. As evidence of practicality, the press release noted only that his specially-modified G46 flew through the weather that grounded other aircraft. Manufacturers had begun building similar de-icing systems, though few followed Rodert's suggestions. Still, despite the narrow practicality of Rodert's work, he was indeed largely responsible for getting industry off its duff. The Collier Trophy testified to the peculiar and fruitful synergism of his personality with the NACA advisory committee form of research.
Derived from text
Aircraft Design; Aircraft Icing; Deicers; Deicing; Ice Formation; Wind Tunnel Tests; Aerodynamic Heat Transfer

19990025651 Federal Aviation Administration, Airport and Aircraft Safety Research and Development, Atlantic City, NJ USA
Fire-Resistant Materials ***Final Report***
Lyon, Richard E., Editor; Nov. 1998; 294p; In English
Report No.(s): AD-A359299; DOT/FAA/AR-97/100; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

This report details the research being conducted by the Federal Aviation Administration (FAA) to develop fire-safe cabin materials for commercial aircraft; The objective of the Fire-Resistant Materials program is to eliminate burning cabin materials as a cause of death in aircraft accidents. Long-term activities include the synthesis of new, thermally stable, low fuel value organic and inorganic polymer systems. The synthesis effort is supported by fundamental research to understand polymer combustion and fire resistance mechanisms using numerical and analytic modeling and the development of new characterization techniques. Aircraft materials which are targeted for upgraded fire resistance are (1) thermoset resins for interior decorative panels, secondary composites, and adhesives; (2) thermoplastics for decorative facings, telecommunication equipment, passenger service units, molded seat parts, transparencies, and electrical wiring; (3) textile fibers for upholstery, carpets, decorative murals, tapestries; and (4) elastomers/rubber for seat cushions, pillows, and sealants. During the first 2 years of the program (1995-1996) we have made significant progress in achieving our interim goal of a 50 percent reduction in the heat release rate of cabin materials by 2005 and zero heat release rate cabin materials by 2018 with respect to the 1996 baseline for new aircraft. A previous report, Fire-Resistant Materials: Research Overview, DOT/FAA/AR-97/99, summarizes the background and technical objectives of the program and serves as an introduction to the present document.
DTIC
Thermal Stability; Thermoplastic Resins; Sandwich Structures; Heat Transfer; Flame Retardants; Aircraft Accidents; Characterization; Elastomers

19990025959 Naval Postgraduate School, Monterey, CA USA
The Marine Corps Flying Hour Program at Marforlant
Gariner, Edward C.; Dec. 1998; 131p; In English
Report No.(s): AD-A358803; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The goal of this thesis is to determine the best way to manage the Flying Hour program (FHP) from the perspective of the U.S. Marine Forces Atlantic (MAPFORLANT) Aviation Budget Officer. The thesis has two main objectives. The first objective is to describe the organization and current financial management issues related to the FHP at the Department of the Navy (DON) and MARFORLANT levels. An historical overview of the FHP, an analysis of federal and defense budgeting dynamics, and an impact analysis of the Marine Aviation Campaign Plan are provided. The second objective is to conduct quantitative analysis of selected MARFORLANT data to better understand FHP cost behavior. Regression results are compared with previous DON research to determine the suitability of Cost Per Hour as the most reliable FHP metric. Analysis confirmed that there is a direct relationship between fuel and flight hours, but showed virtually no correlation between flight hours and aviation maintenance costs. These findings indicate that regression models show too much variability for them to be used to displace the DON OP-20 model as the primary means for budget forecasting for the FHP. The thesis concludes that the Aviation Budget Officer must continue to rely on qualitative budgeting skills to maximize the financial condition of MARFORLANT Aviation.
DTIC
Aircraft Maintenance; Budgeting; Correlation; Financial Management; Histories

19990026194 Air Force Research Lab., Materials and Manufacturing Directorate, Wright-Patterson AFB, OH USA

Cut Progression during Dynamometer Testing of Foreign Object Damaged Type 7 Extra High Pressure Aircraft Tires ***Final Report, 15 Mar. 1984 - 15 Jun. 1991***

Vorum, Peter C.; Sep. 1991; 19p; In English

Contract(s)/Grant(s): Proj-2402

Report No.(s): AD-A359483; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Ground operations over rough surfaces and/or debris strewn taxiways and runways may result in cut damage to the tires. Cut progression during continued flight operations has not been seriously studied. This report will follow a group of Type 7 Extra High Pressure tires which were damaged by running them over a debris strewn test bed, then run though alternating taxi-takeoff and landing-taxi tests on the 3.05 meter (120 inch) dynamometer in the Landing Gear Development Facility at Wright-Patterson Air Force Base. Only 1.3 - 23% of the debris struck by these tires resulted in cuts. While testing on the dynamometer, the cut depth grew rapidly until it reached the outer carcass ply, then slowed. The test group included new and recapped bias ply, and prototype radial main landing gear tires. This paper will summarize the tire tests and offer recommendations for future evaluation of the tires and materials.

DTIC

Inspection; Landing Gear; Runways; Damage; Aircraft Tires; Aircraft Maintenance

19990026309 Nebraska Univ., Kearney, NE USA

An Examination of the US Airline Policy Regarding Child Restraint Systems

Carstenson, Larry, Nebraska Univ., USA; Sluti, Donald, Nebraska Univ., USA; Luedtke, Jacqueline, Utah State Univ., USA; Collegiate Aviation Review; September 1997, pp. 1-12; In English; See also 19990026308; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This study examined the policy of the U.S. commercial air carriers regarding the use of infant restraint systems on aircraft. The study determined whether airline management and airline personnel understand that policy and whether that policy is effectively communicated to the traveling public. This study investigated the effectiveness of communication between airline management and airline personnel regarding airline policy for the carriage of infants in commercial airplanes. The results of this survey were analyzed in order to determine if any recommendations could be made to the airlines regarding child restraint systems on commercial aircraft.

Author

Examination; Airline Operations; Policies; Child Device

19990026310 University of Central Washington, Ellensburg, WA USA

Advanced Qualification Training: A Study of Implementation of CRM into Airline Training

Matteson, Roger C., University of Central Washington, USA; Collegiate Aviation Review; September 1997, pp. 13-18; In English; See also 19990026308; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The emphasis in training pilots on today's aircraft is placed on preparing the crew to interact with each other and to recognize any problem that may occur long before such a problem becomes a flight hazard. The training that is necessary to do this is called Crew Resource Management (CRM). Although CRM has been used by the airlines for about the past ten years, no integrated training among the airlines has been formulated until recently. Recent pressure from outside sources has prompted the FAA to initiate action to formalize CRM training in the airlines. The Federal Aviation Administration (FAA) established Special Federal Aviation Regulation (SFAR) 58, which created the Advanced Qualification Program (AQP) (Federal Aviation Administration, 1990). This allowed the airlines to develop their own training program which incorporates CRM and Line Operational Simulations (LOS). LOS utilizes simulator training using a typical operational passenger flight scenario, in a controlled training environment, It is designed to improve cockpit/cabin communication and coordination skills, and pilot decision-making skills (Federal Aviation Administration, 1995).

Author

Airline Operations; Civil Aviation; Training Aircraft; Training Simulators; Education; Decision Making; Coordination

19990026322 Aeronautical Systems Div., Wright-Patterson AFB, OH USA

Corrosion and Fatigue: Safety Issue or Economic Issue

Lincoln, John W., Aeronautical Systems Div., USA; Fatigue in the Presence of Corrosion; March 1999; 5p; In English; See also 19990026320; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

Corrosion and fatigue separately have both led to serious safety as well as economic problems. Corrosion alone, in forms such as uniform corrosion or exfoliation, may reduce the strength of aircraft and lead to failure. Both of these forms of corrosion may

lead also to expensive component repair or replacement. There are many cases where corrosion alone is not significant from a safety consideration, but is a very significant economic problem. In the case of corrosion alone, one must judge the seriousness of this problem on an individual basis. Nondestructive inspections have found fatigue problems where there is essentially no influence from corrosion. Researchers have documented many cases over the years where the consequences were catastrophic. The results of fatigue cracking have caused many expensive repairs and modifications to the structure including component replacement. Fatigue often combines synergistically with corrosion. In these cases, the term corrosion fatigue is more appropriate. In most cases, corrosion, fatigue, or corrosion fatigue becomes a safety consideration only when either maintenance is not performed properly or the maintenance program is inappropriate. Experience derived from diligent maintenance has repeatedly shown that the operator need not compromise safety resulting from these problems. The purpose of this paper is to describe some experiences with corrosion, fatigue, and corrosion and fatigue and to review some of the relative literature on this subject.
Author
Fatigue (Materials); Corrosion; Structural Failure; Aircraft Maintenance; Aircraft Structures; Nondestructive Tests; Inspection; Corrosion Tests; Fatigue Tests

19990026441 Naval Postgraduate School, Monterey, CA USA
Automating the Aviation Command Safety Assessment Survey as an Enterprise Information System (EIS)
Held, Jonathan S.; Mingo, Fred J., Jr.; Mar. 1999; 319p; In English
Report No.(s): AD-A360024; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche

The Aviation Command Safety Assessment (ACSA) is a questionnaire survey methodology developed to evaluate a Naval Aviation Command's safety climate, culture, and safety program effectiveness. This survey was a manual process first administered in the fall of 1996. The primary goal of this thesis is to design, develop, and test an Internet-based, prototype model for administering this survey using new technologies that allow automated survey submission and analysis. The result of this thesis is a web site http://spitfire.avsafety.nps.navy.mil that adheres to a three-tier client/server architecture. The back-end SQL server database used to store survey information is accessed via front-end Java applets or Hypertext Markup Language (HTML) forms. Middleware components that complete the connection between client and server include Weblogic's Fastforward JDBCTM driver and Java servlets. The ACSA web site utilitizes many Internet technologies: Active Server Pages (ASP), HTML, Javascript, Active X, Secure Sockets Layer (SSL), COl scripts, JDBCTM, and Java applets and servlets. This thesis leads the reader through the research and development process describing how each of these technologies is used. Thorough review of this material is necessary for lifecycle support and fliture project revisions. Complete source code can be found in the appendices.
DTIC
Client Server Systems; Data Bases; Aircraft Safety; Flight Safety; Information Systems

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.

19990026081 Civil Aeromedical Inst., Oklahoma City, OK USA
Reduced Flight Process Strips in En Route ATC Mixed Environments ***Final Report***
Durso, Francis T., Oklahoma Univ., USA; Truitt, Todd R., Oklahoma Univ., USA; Hackworth, Carla A., Oklahoma Univ., USA; Albright, Chris A., Oklahoma Univ., USA; Bleckley, M. Kathryn, Oklahoma Univ., USA; Manning, Carol A., Civil Aeromedical Inst., USA; Oct. 1998; 26p; In English
Contract(s)/Grant(s): DTFA-02-93-D-93088
Report No.(s): DOT/FAA/AM-98/26; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Currently, en route control of high altitude flights between airports uses computer-augmented radar information available on the Plan View Display (PVD), Computer Readout Device (CRD), and flight information printed on Flight Progress Strips (FPSs). The FPS contains thirty-one fields that supplement data available on the PVD. While an aircraft is in a controller's sector, control instructions, changes to the flight plan, and other contacts with the aircraft are written on the corresponding strip. This report describes an experiment that compared the effects of using a standard-sized (1 and 5/16" x 8") FPS and an FPS reduced both in size (1" x 5") and information on the performance and workload of controller teams. The teams, from Minneapolis ARTCC, controlled simulated air traffic in a mixed radar-non-radar environment. Overall, the 1" x 5" reduced strip yielded deficits in the control of nonradar flights but not radar flights. This was evidenced in subject matter experts' evaluation of non-radar separation, strip

processing and board management, and, to a marginal extent, in the efficiency of traffic movement through the sector. The radar-side (R-side) controller's awareness was also rated lower when using the smaller strips. Interestingly, the controllers' evaluation of their own performance did not reflect a difference between smaller and normal-sized strips. This may help explain why controllers did not compensate for the smaller strips to any great extent. Only R-side controllers exhibited compensatory behaviors and reported increased workload. R-side controllers also pointed to the PVD more often. Although there was little compensatory activity, R-side Controllers thought workload was greater with smaller strips. R-side controllers also felt it was more effortful and more frustrating working with the 1" x 5" strips. Despite the self-reported heavier workload, controllers nevertheless were able to perform secondary tasks, such as granting pilot requests, as often and as quickly using smaller strips as they did using standard strips. This study also described specific air traffic activities likely to be affected by a reduction to a 1" x 5" FPS. Strip marking, speed of strip processing, and some aspects of board management seemed especially affected. Inferior strip marking was evidenced in the on-line expert evaluation and controllers often reported that the size of the 1" x 5" strip prevented writing. The ability to locate a particular strip and find the information on it seems to suffer with a reduction in size as tested in this study. On-line expert evaluations and controller opinions echoed this problem. Locating strips might have been especially difficult for the R-side, thus leading to large differences in self-reported frustration. Controllers also noted specific problems with the strip display, including the use of shading to replace information typically presented in red. of board management responsibilities, considered by controllers as generally inferior with 1" x 5" strips, removal of deadwood seems less likely to be negatively affected by reduction in strip size. The on-line expert evaluation rated the 1" x 5" strips negatively and the subject matter experts recorded more negative comments about removal of deadwood under that condition. Overall, this study does not permit recommendation of the 1" x 5" reduced strip as designed for this study. Suggestions for improving a less than standard size FPS are provided.
Author
Flat Panel Displays; Automated En Route ATC; Radar Approach Control; Flight Management Systems; On-Line Systems; Air Traffic Controllers (Personnel)

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.

19990025571 Northeastern Univ., Boston, MA USA
The X-15 Hypersonic Flight Research Program: Politics and Permutations at NASA, Chapter 6
Kay, W. D., Northeastern Univ., USA; From Engineering Science to Big Science: The NACA and NASA Collier Trophy Research Project Winners; 1998, pp. 149-164; In English; ISBN 0-16-049640-3; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Two features of the X-15 program, an outstanding piece of machinery flown by exceptionally brave and skilled pilots stand as the legacy of the program. The problem with the prevailing view is not so much that it is wrong but that it is incomplete. The program has been extolled for the contributions to aerospace engineering. However little has been written about its overall management, and the difficulties which had to be overcome. This chapter tells of the program to develop the X-15, and the administrative achievements in the light of the technical problems. It examines the administrative and political factors that played a role in the success.
CASI
Hypersonic Flight; Aerospace Engineering; X-15 Aircraft

19990025572 Auburn Univ., Dept. of History, AL USA
Engineering Science and the Development of the NACA Low-Drag Engine Cowling, Chapter 1
Hansen, James R., Auburn Univ., USA; From Engineering Science to Big Science: The NACA and NASA Collier Trophy Research Project Winners; 1998, pp. 1-27; In English; ISBN 0-16-049640-3; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The agency, that preceded NASA, the National Advisory Committee for Aeronautics (NACA), won its first of five Collier Trophies in 1929, and did so basically for advancing a couterintuitive idea. The idea, which flew in the face of a conventional wisdom about proper aircraft design, ventured the following: covering up --not leaving open to the air -- the cylinders of an air-cooled radial engine could not only dramatically reduce aerodynamic drag but actually, improve engine cooling. The immediate product of this startling engineering insight was the NACA's development of a low-drag engine "cowling," the winner of the 1929 Collier Trophy. Put simply the NACA cowling was a metal shroud for a radial air-cooled engine. As the essay intends to show,

the technological process represented in the NACA's cowling investigation was of a particular type that has often proved fundamental to progress not only in aviation but in all engineering fields. It was not the path of inspired genius the public had come to want, but neither was it meer development. Rather, the NACA cowling was something more fundamental and harder to identify, let alone comprehend. It was the fruitful product at a government lab of what historians of technology have come to call engineering science.
Derived from text
Aerodynamic Drag; Air Cooling; Aircraft Design; Cowlings; Product Development; Aeronautical Engineering; Histories

19990025634 Maryland Univ., Dept. of Aeronautical Engineering, College Park, MD USA
Research in Supersonic Flight and the Breaking of the Sound Barrier, Chapter 3
Anderson, John D., Jr., Maryland Univ., USA; From Engineering Science to Big Science: The NACA and NASA Collier Trophy Research Project Winners; 1998, pp. 59-90; In English; ISBN 0-16-049640-3; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The National Advisory Committee for Aeronautics' (NACA) work on high speed aerodynamics described in this chapter is also one of the early examples in the history of aerodynamics where engineering science played a deciding role. In this chapter we shall see that NACA researchers in the 1920's and 1930's were working hard to discover the scientific secrets of high-speed aerodynamics just so they could properly design airfoils for high-speed flight. Also within the general framework of the historical evolution of aerodynamic thought over the centuries, the NACA's highspeed research program is among the earliest examples of engineering science.
CASI
Acoustic Velocity; Aerodynamics; Airfoils; Supersonic Flight; Transonic Flight; Compressible Flow; Propellers

19990025936 Air Force Research Lab., Human Effectiveness Directorate, Brooks AFB, TX USA
Testing and Evaluation of the Mine Safety Appliances, Co., Model 3000, Oxygen Monitor ***Final Report***
Sylvester, James C.; Nov. 1998; 16p; In English
Contract(s)/Grant(s): Proj-7184
Report No.(s): AD-A359546; AFRL-HE-BR-TR-1998-0120; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Mine Safety Appliances, Co., Model 3000, Oxygen Monitor is an oxygen monitor designed to provide continuous, direct monitoring of oxygen mixtures. The unit operates on a 9V internal battery. The unit weighs approximately 260 Gm or 9.2 oz. and is 3.25 in. W. X 5.98 in. H. X 1.31 in D.
DTIC
Oxygen Supply Equipment; Evacuating (Transportation); Medical Equipment; Oxygen

19990025938 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
Structural Investigation of the F-14 TARPS CD Pod
Pratt, Jack B.; Jan. 07, 1999; 16p; In English
Report No.(s): AD-A359550; NAWCADPAX--99-7-SAR; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report presents the results of a structural evaluation of the Tactical Air Reconnaissance Pod System (TARPS) completely digital (CD) pod for demonstration flights on the F-14 aircraft. Based upon evaluation presented in this report, it is recommended the TARPS CD pod be authorized for flight test to the current F-14 NATOPS limits when configured with a standard TARPS pod, including carrier suitability operations.
DTIC
F-14 Aircraft; Structural Analysis; Flight Tests; Pods (External Stores); Reconnaissance Aircraft; Aerial Reconnaissance

19990025946 Logicon Technical Services, Inc., Dayton, OH USA
SEAD and the UCAV: A Preliminary Cognitive Systems Analysis ***Interim Report, May 1997 - Feb. 1998***
Flach, John M.; Eggleston, Robert G.; Kuperman, Gilbert G.; Dominguez, Cynthia O.; Feb. 1998; 58p; In English; Prepared in cooperation with Wright State Univ., Fairborn, OH.
Contract(s)/Grant(s): F41624-94-D-6000; AF Proj. 7184
Report No.(s): AD-A358833; AFRL-HE-WP-TR-1998-0013; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report is the first step of a program with three explicit goals: (1) to illustrate and test the framework of Cognitive Systems Engineering (CSE) for use in military systems analysis and design; (2) to generate a database that will be useful for designers and managers working on the development of UCAVs for use in the SEAD mission; and (3) to develop interfaces for UCAVs. These goals are tightly coupled in that the usefulness of the database and the ability to develop effective interfaces and user-aiding

concepts will be the true test of the CSE framework. The report is most relevant to the second goal. It provides a CSE framework for interpreting and organizing data generated from cognitive task analyses of the SEAD mission. The CSE framework is unique in that it develops a holistic approach to human-socio-technical systems. It explicitly considers factors in design analysis that go beyond the technology boundaries of a system to reveal important constraints for proper consideration in the process of synthesizing a design concept. The report illustrates initial benefits of this form of system analysis.
DTIC
Data Bases; Mental Performance; Systems Analysis; Systems Engineering

19990026041 General Accounting Office, National Security and International Affairs Div., Washington, DC USA
Unmanned Aerial Vehicles: Progress Toward Meeting High Altitude Endurance Aircraft Price Goals
Dec. 1998; 11p; In English; Report to Congressional Committees.
Report No.(s): AD-A358637; GAO/NSIAD-99-29; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Section 216 of the National Defense Authorization Act for Fiscal Year 1998 directed us to review the Department of Defense's (DOD) High Altitude Endurance (HAE) Unmanned Aerial Vehicle (UAV) program to determine whether the average flyaway cost for the Global Hawk and DarkStar HAE alr vehicles will be within DOD's cost goal of $10 million As agreed with your office, this report addresses the status of DOD'S progress toward meeting its goal as the HAE program proceeds through its ongoing demonstration phase. DOD does not expect to be able to produce DarkStar or Global Hawk HAE vehicles within its goal of $10 million per unit in fiscal year 1994 dollars. DOD'S price projections, which updated the original estimates of $10 million, are currently $13.7 million for DarkStar and $14.8 million for Global Hawk, In addition, these projections may understate the actual amount by which the UAV'5 unit price will exceed $10 million because in their agreements with the HAE contractors, program officials used a defamation of unit flyaway price that excludes several cost categories that are traditionally included in determining unit flyaway cost. Including these costs will increase the average unit price of each air vehicle. United States General Accounting Office Washington, D.C. 20548 National Security and International Affairs Division B-280126 December 15, 1998 Congressional Committees Section 216 of the National Defense Authorization Act for Iliscal Year 1998 directed us to review the Department of Defense's (DOD) High Altitude Endurance (HAE) Unmanned Aerial Vehicle (UAv) program to determine whether the average flyaway cost for the Global Hawk and DarkStar HAE alr vehides will be within DOD's cost goal of $10 million.1 As agreed with your office, this report addresses the status of DOD'S progress toward meeting its goal as the HAE program proceeds through its ongoing demonstration phase.
DTIC
Defense Program; Estimates; High Altitude; Pilotless Aircraft; Reconnaissance Aircraft

19990026115 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
Service History of the F-111 Wing Pivot Fitting Upper Surface Boron/Epoxy Doublers
Chalkley, Peter, Defence Science and Technology Organisation, Australia; Geddes, Rowan, Defence Science and Technology Organisation, Australia; Sep. 1998; 15p; In English; Original contains color illustrations
Report No.(s): DSTO-TN-0168; DODA-AR-010-643; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

Several of the boron/epoxy doublers applied to upper surface of RAAF F-111C wing-pivot-fittings (WPFS) have disbonded. Based on RAAF records, a total of seven wings (out of forty to which doublers have been applied) have confirmed disbonds: A15-3, A15-5, A15-10, A15-14, A15-19, A15-20 and A15-284R. Most of the disbonds are forming in the smaller forward doubler (five confirmed) although three aft doublers have also disbonded. This report documents the service history of all doublers applied to RAAF F-111Cs. The current investigation suggests that disbonds in the boron/epoxy doublers on the upper surface of F-111 WPFs are forming within 1000 AFHRS service. However, infrequent inspections of the doublers make a precise determination difficult. Issues such as the use of external wing tanks on some aircraft (especially RF111Cs), disbond initiation sites and below tolerance wing skin thicknesses are investigated.
Author
F-111 Aircraft; Wings; Pivots; Inspection; Defects; Debonding (Materials); Boron-Epoxy Composites

19990026259 Instituto Nacional de Tecnica Aeroespacial, Torrejon de Ardoz, Spain

Application of the Theory of Control on Aerodynamic Design: Theoretical Development ***Aplicacion de la teoria de Control al diseno aerodinamico. Desarrollo teorica.***

Jun. 16, 1997; 26p; In Spanish

Report No.(s): AT/TNO/4510/INTA/97; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper is a study on the application of control to aerodynamic design. The problem of the optimization of certain profiles such as to extend the geometry (wing design), fluid models, and aerodynamic coefficients were solved by the examination of various linear equations. Euler's two- and three-dimensional problems, and the finite difference theory were used consistently throughout this paper. In this numerical optimization a significant amount of time was dedicated to the pressure distribution because of its significance to the ultimate design of the models.

CASI

Optimal Control; Aircraft Design; Incompressible Flow; Computational Fluid Dynamics; Euler Equations of Motion; Finite Difference Theory

19990026323 British Aerospace Airbus Ltd., Bristol, UK

The Effect of Corrosion on the Structural Integrity of Commercial Aircraft Structure

Worsfold, Martin, British Aerospace Airbus Ltd., UK; Fatigue in the Presence of Corrosion; March 1999; 10p; In English; See also 19990026320; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The purpose of this paper is to discuss the effect of corrosion on the structural integrity of commercial aircraft wing structure. Data is presented for fatigue specimens tested with corrosion damage and following a spotface repair operation. The data demonstrates that failure initiates earlier from specimens with corrosion damage, when compared to corrosion free specimens, and that the reduction in fatigue life was due to a shortened crack initiation period.

Author

Corrosion; Structural Failure; Aircraft Maintenance; Wings; Fatigue Life; Commercial Aircraft; Crack Initiation; Aircraft Reliability

19990026324 Divisione Aerea Studi Ricerche e Sperimentazioni, Chemical-Technological Dept., Pratica di Mare, Italy

Aging Aircraft: In Service Experience on MB-326

Colavita, Mario, Divisione Aerea Studi Ricerche e Sperimentazioni, Italy; Dati, Enrico, Divisione Aerea Studi Ricerche e Sperimentazioni, Italy; Trivisonno, Giovanni, Divisione Aerea Studi Ricerche e Sperimentazioni, Italy; Fatigue in the Presence of Corrosion; March 1999; 6p; In English; See also 19990026320; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

In 1996 a European research project on Structure Maintenance of Aging Aircraft (SMAAC), where a consistent number of partners decided to cooperate in order to offer an answer to this problem was begun. The first purpose of the research project was joining the In-Service Experiences that allow to relate all structural and chemical degradation induced by corrosion to the potential interactions with fatigue. Italian Air Force (IAF) and AerMacchi decided to carry out a tear-down inspection on a 30 year old Macchi MB-326, a small trainer aircraft, having 4685 flight hours with respect to 5979 safe life hours. For this purpose the chosen test articles were fuselage center section, tailplane, wings, and front fuselage. The first two of them were investigated at the Air Force laboratories and the other ones at the AerMacchi research department. Particular attention was focused on the components subjected to the high stress and potential corrosion in areas not accessible during routine servicing.

Author

Fatigue (Materials); Corrosion; Structural Failure; Aircraft Reliability; Aircraft Maintenance; Aircraft Structures; Stress Corrosion; Inspection; Service Life

19990026326 Patras Univ., Lab. of Technology and Strength of Materials, Greece

The Effect of Existing Corrosion on the Structural Integrity of Aging Aircraft

Pantelakis, S. G., Patras Univ., Greece; Kermanidis, T. B., Patras Univ., Greece; Daglaras, P. G., Patras Univ., Greece; Apostolopoulos, C. A., Patras Univ., Greece; Fatigue in the Presence of Corrosion; March 1999; 14p; In English; See also 19990026320; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Investigation on effects of existing corrosion on the structural integrity of aging aircraft structures was made. The study included characterization of the tensile behaviour as well as determination of the fatigue and fatigue crack growth behaviour of structural aircraft aluminium alloys following corrosion exposure. The investigation of the tensile behaviour following corrosion exposure was performed on the aluminium alloys 2024, 8090, 2091, and 6013. The materials were exposed to five different accelerated laboratory corrosion tests; alloy 2024 T351 was also subjected to out-door exposure. Evaluation has shown an appreciable

decrease of yield and ultimate tensile stress caused by corrosion attack on the materials surface layers. In addition, a dramatic volumetric embrittlement of the corroded materials was observed; it has been associated to hydrogen penetration and absorption. The influence of existing corrosion on fatigue life and fatigue crack growth of 2024 alloy was evaluated as well. Obtained S-N curves are confirming the expected decrease of fatigue life following corrosion. Fatigue crack growth tests performed for several R-ratios have shown that crack growth rates are practically not practically influenced by existing corrosion, yet, this result should not be misinterpreted as an insignificance of existing corrosion for the damage tolerance behaviour of the structure.
Author
Corrosion; Structural Failure; Aircraft Structures; Aluminum Alloys; Corrosion Tests; Crack Propagation; Hydrogen Embrittlement; Fatigue Life; Tensile Stress

19990026333 Air Force Research Lab., Robins AFB, GA USA
Corrosion in USAF Aging Aircraft Fleets
Kinzie, Richard, Air Force Research Lab., USA; Cooke, Garth, Air Force Research Lab., USA; Fatigue in the Presence of Corrosion; March 1999; 12p; In English; See also 19990026320; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper summarizes the results of research projects undertaken by the USA Air Force Corrosion Program Office within the past year and a half. It reflects the cooperative results obtained from a team of almost 50 researchers that represented over a dozen different corporate entities. All were marching to a tune composed and conducted by the program office. This paper covers work associated with environmental modeling, development of a revised corrosion maintenance concept, and development of a corrosion growth model that can be used by depot engineers to improve the maintenance of their aircraft.
Author
Fatigue (Materials); Military Aircraft; Corrosion; Structural Failure; Aircraft Reliability; Aircraft Maintenance

19990026338 Analytical Processes/Engineered Solutions, Inc., Saint Louis, MO USA
Integrating Real Time Age Degradation Into the Structural Integrity Process
Brooks, Craig L., Analytical Processes/Engineered Solutions, Inc., USA; Simpson, David, Institute for Aerospace Research, Canada; Fatigue in the Presence of Corrosion; March 1999; 13p; In English; See also 19990026320; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The principal focus of this paper is to describe a process for incorporating the ”age degradation” aspects of aircraft into the existing infrastructure of the design, manufacturing, and maintenance of aircraft systems. The tailoring of the structural integrity process enables the industry and the user communities to meet the needs, opportunities, and challenges being presented by the Aging Aircraft Fleet. The economic and safety impact of the continued use of some aircraft necessitates an enhancement to the existing system. This paper describes the rationale, approaches, and techniques to evolve the structural integrity process to include the effects of corrosion, sustained stress corrosion cracking, and other age related degradation effects. A viable method of utilizing the proposed approach is presented in a fashion to realize benefits throughout the full life cycle of aircraft systems.
Author
Fatigue (Materials); Corrosion; Structural Failure; Aircraft Maintenance; Aging (Metallurgy); Degradation; Real Time Operation; Stress Corrosion Cracking; Manufacturing

19990026392 Department of Energy, Washington, DC USA
Experimental flight test vibration measurements and nondestructive inspection on a USCG HC-130H aircraft
Moore, D. G., Department of Energy, USA; Jones, C. R., Department of Energy, USA; Mihelic, J. E., Department of Energy, USA; Barnes, J. D., Department of Energy, USA; Dec. 31, 1998; 10p; In English; 2nd; Aging aircraft; Sponsored by NASA, USA
Report No.(s): DE98-006173; SAND-98-0248C; CONF-980830; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This paper presents results of experimental flight test vibration measurements and structural inspections performed by the Federal Aviation Administration’s Airworthiness Assurance NDI Validation Center (AANC) at Sandia National Laboratories and the US Coast Guard Aircraft Repair and Supply Center (ARSC). Structural and aerodynamic changes induced by mounting a Forward Looking Infrared (FLIR) system on a USCG HC-130H aircraft are described. The FLIR adversely affected the air flow characteristics and structural vibration on the external skin of the aircraft’s right main wheel well fairing. Upon initial discovery of skin cracking and visual observation of skin vibration in flight by the FLIR, a baseline flight without the FLIR was conducted and compared to other measurements with the FLIR installed. Nondestructive inspection procedures were developed to detect cracks in the skin and supporting structural elements and document the initial structural condition of the aircraft. Inspection results and flight test vibration data revealed that the FLIR created higher than expected flight loading and was the possible source of the skin cracking. The Coast Guard performed significant structural repair and enhancement on this aircraft, and additional in-flight vibra-

tion measurements were collected on the strengthened area both with and without the FLIR installed. After three months of further operational FLIR usage, the new aircraft skin with the enhanced structural modification was reinspected and found to be free of flaws. Additional US Coast Guard HC-130H aircraft are now being similarly modified to accommodate this FLIR system. Measurements of in- flight vibration levels with and without the FLIR installed, and both before and after the structural enhancement and repair were conducted on the skin and supporting structure in the aircraft's right main wheel fairing. Inspection results and techniques developed to verify the aircraft's structural integrity are discussed.
NTIS
Flight Tests; Vibration Measurement; Aircraft Maintenance; Inspection; Nondestructive Tests

19990026436 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Velocity Field Over Delta Wings at High Angles of Attack
O'Dowd, Devin O.; Feb. 08, 1999; 66p; In English
Report No.(s): AD-A359980; AFIT-FY99-81; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
The study of vortex breakdown over delta wings at high angles of attack (AOA) has been an interest to researchers, mathematicians, and aircraft designers for decades. It is a very hot topic as it relates to many aircraft being designed today and because no complete understanding exists. Most of the understanding that does exist comes in the form of the problems associated with vortex breakdown. Many question if it is possible to control the breakdown to avoid the problems and to aid the aircraft in maneuverability. The purpose of this study is to lay the foundation for future research at the University of Washington, so that the identity to the cause of the vortex breakdown may be found.
DTIC
Vortex Breakdown; Aircraft Maneuvers; Delta Wings

19990026503 Tennessee Univ., Knoxville, TN USA
The Development of a Verification and Validation (V and V) Plan for a Proposed Tactical Engagement Simulation System for the AH-64D Attack Helicopter
Pupalaikis, Robert A.; Nov. 1998; 177p; In English
Report No.(s): AD-A359363; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche
Advances in weapon systems technology creates the potential for increased warfighting capability. These advances simultaneously create the need for effective simulation systems of these contemporary technologies. The credibility and capability of these weapons systems Models and Simulation (M&S) are evaluated by a Verification and Validation (V&V) process, typically performed during the system development and subsequent Developmental Testing (DT). The tactical effectiveness and suitability of the integrated system are then evaluated through Operational Testing (OT). Historically, the tasks associated with DT and OT are performed by separate organizations in isolation. This thesis proposes a methodology for the Verification and Validation of the weapons systems models implicit in the AH-64D Longbow Apache Tactical Engagement Simulation (TES) System. In addition, this thesis develops a V&V plan to evaluate the simulation provided by the integrated Longbow TES system. The design of this plan provides for the simultaneous collection of OT data to support system suitability evaluation. This will reduce future OT requirements, thus decreasing the time required for the acquisition cycle. This proposition of performing the TES V&V as a combination of DT (V&V) and OT supports the rapid prototyping philosophy which is useful in proving the concepts of new technology and complex systems.
DTIC
Computerized Simulation; Helicopters; Weapon Systems; Systems Simulation; Systems Engineering; Data Acquisition

19990026605 NASA Dryden Flight Research Center, Edwards,CA USA
A Base Drag Reduction Experiment on the X-33 Linear Aerospike SR-71 Experiment (LASRE) Flight Program
Whitmore, Stephen A., NASA Dryden Flight Research Center, USA; Moes, Timothy R., NASA Dryden Flight Research Center, USA; Mar. 1999; 21p; In English; 37th; Aerospace Sciences, 11-14 Jan. 1999, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 242-33-02
Report No.(s): NASA/TM-1999-206575; H-2333; NAS 1.15:206575; AIAA Paper 99-0277; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Drag reduction tests were conducted on the LASRE/X-33 flight experiment. The LASRE experiment is a flight test of a roughly 20% scale model of an X-33 forebody with a single aerospike engine at the rear. The experiment apparatus is mounted on top of an SR-71 aircraft. This paper suggests a method for reducing base drag by adding surface roughness along the forebody. Calculations show a potential for base drag reductions of 8-14%. Flight results corroborate the base drag reduction, with actual

reductions of 15% in the high-subsonic flight regime. An unexpected result of this experiment is that drag benefits were shown to persist well into the supersonic flight regime. Flight results show no overall net drag reduction. Applied surface roughness causes forebody pressures to rise and offset base drag reductions. Apparently the grit displaced streamlines outward, causing forebody compression. Results of the LASRE drag experiments are inconclusive and more work is needed. Clearly, however, the forebody grit application works as a viable drag reduction tool.
Author
Aerodynamic Drag; Drag Reduction; Flight Tests; Drag Measurement

19990026607 National Aerospace Lab., Amsterdam Netherlands
Design Optimization of Stiffened Composite Panels With Buckling and Damage Tolerance Constraints; Presented at the AIAA-SDM Conference (39th) Held at Long Beach, California on April 20-23 1998
Wiggenraad, J. F.; Arendsen, P.; da Silva Pereira, J. M.; Jan. 1998; 15p; In English
Report No.(s): AD-A359832; NLR-TP-98024; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The design of stiffened, composite wing panels must satisfy a range of requirements related to performance, economy and safety. In particular, the design must be damage tolerant to satisfy a number of different performance requirements for various states of damage. to obtain an optimum configuration that satisfies these requirements simultaneously, optimization code PANOPT was extended with a multi-model capability. First, the effect of damage tolerance constraints on postbuckled optimum design was established for blade- I- and hat-stiffened panels with stiffener flanges embedded in the skin. The classical" order of efficiency for optimized panels designed for buckling alone (hats, I's, blades) was no longer valid, as the masses of the three panel types were approximately equal. to obtain realistic damage models, the failure mechanisms and damage tolerance of the panel concept with embedded stiffeners were determined in an experimental programme. Finally, the multi-model capability PANOPT was demonstrated with the simultaneous optimization of undamaged panel carrying design ultimate load, the same panel with a separated stiffener carrying design limit load, and the panel with a cut stiffener carrying seventy percent of the design limit load. An optimum design was found with an additional mass of only five percent compared to a panel optimized for the undamaged case alone.
DTIC
Composite Structures; Degradation; Buckling; Airframes; Panels; Fault Tolerance; Structural Design

06
AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments. For related information see also 19 Spacecraft Instrumentation and 35 Instrumentation and Photography.

19990025942 Illinois Univ., Urbana, IL USA
Frames of Reference for Electronic Map Displays: Their Effect on Local Guidance and Global Situation Awareness During Low Altitude Rotorcraft Operations
Poole, Patrick E.; Jan. 07, 1999; 92p; In English
Report No.(s): AD-A359797; AFIT-FY99-29; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

This study sought to examine frame of reference for electronic map displays and determine its effect on pilot local guidance ability and global situation awareness (GSA) during low altitude rotorcraft flights. It was hypothesized that the egocentric viewpoint would support superior local guidance ability, the egocentric viewpoint would facilitate better GSA, and the Situation Awareness Rating Technique (SART) would not be a good measure of GSA. Eighteen pilots flew simulated missions on six possible paths, with three paths flown at 200 feet and three paths flown at 1,000 feet. All participants flew both a low altitude and a high altitude scenario with each of three display viewpoints (egocentric, exocentric, 2D), for a total of six missions. Results revealed that the forward field of view present in the simulation appears to mute the effect of display type on local guidance ability such that all three of the viewpoints evaluated provided equivalent navigation performance. The results for the level of GSA achieved revealed that the egocentric viewpoint suffered with regards to facilitating GSA, but no differences were revealed between the exocentric and 2D viewpoints. Furthermore, the GSA results suggested that the SART may not be a good measure of global situation awareness. Results are discussed in terms of map display design for rotorcraft cockpits.
DTIC
Display Devices; Maps; Electronic Equipment; Rotary Wing Aircraft

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.

19990025262 Naval Postgraduate School, Monterey, CA USA
Logistics Simulations Metamodel for F404-GE-300 Engine Maintenance
Stearns III, Dick E.; Dec. 1998; 70p; In English
Report No.(s): AD-A359328; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This thesis presents a simulation metamodel that is used to determine initial rotable pool inventories for F404-GE-400 engine modules onboard a deployed aircraft carrier. Millions of dollars can be saved annually by following the metamodel recommendations for changes and reductions in inventories, while at the same time maximizing F/A-18 squadron operational availability. Managers and leaders in the naval aviation and supply communities should use the metamodel as a tool to modify F404 engine module inventory allowance requirements. The metamodel is valid and provides a real means to address the problem of optimizing module inventory levels with operational availability that before would have been overwhelming and impossible to tackle fully. With the power of today's personal computers, combined with sophisticated simulation programs, simulating the F404 engine module repair process at the afloat Aviation Intermediate Maintenance Depot (AIMD) level is accomplishable. The simulation model is developed from real maintenance and usage data and provides a detailed and accurate representation of the repair process. The results of this thesis can be generalized and applied to a wide family of weapon systems. As military leaders struggle more and more with balancing readiness and limited funds, the metamodel presented in this thesis offers a visible decision-support tool.
DTIC
Aircraft Maintenance; Logistics; Computerized Simulation; Modules

19990025494 Naval Postgraduate School, Monterey, CA USA
Evaluation of a Liquid-Fueled Pulse Detonation Engine Combustor
Forster, David L.; Dec. 1998; 73p; In English
Contract(s)/Grant(s): N00014-98-W-R200
Report No.(s): AD-A359179; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

An evaluation of five liquid-fueled pulse detonation engine combustor geometries and flow field conditions was performed over a wide range of equivalence ratios. Particle sizing and spray characterization of commercially available atomizers was conducted to determine the optimum conditions that produced acceptable mass flow and particle size distribution for use in the combustor. The chosen atomizer was installed in the combustor geometries and then analyzed over a range of combustor conditions to measure deflagration to detonation transition (DDT) distances and detonation wave velocities for each condition. Testing was conducted for ambient (100-110 deg F) and higher wall temperatures (greater than 300 deg F) at an operating frequency of 5Hz. It was found that the shortest DDT for JP10 and O2 was achieved using a stepped front-end insert under hot conditions and with a loaded equivalence ratio greater than .75, but less than 1.15.
DTIC
Ramjet Engines; High Temperature Environments; Detonation Waves; Flow Distribution; Combustion Chambers; Atomizers

19990025583 History Enterprises, Inc., Cleveland, OH USA
The Advanced Turboprop Project: Radical Innovation in a Conservative Environment, Chapter 14
Bowles, Mark D., History Enterprises, Inc., USA; Dawson, Virginia P., History Enterprises, Inc., USA; From Engineering Science to Big Science: The NACA and NASA Collier Trophy Research Project Winners; 1998, pp. 321-343; In English; ISBN 0-16-049640-3; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Not since 1958, had NASA won a Collier Award for innovations in aeronautics. With the development of the Advanced Turboprop engine, this was no longer true. In 1987, the team responsible for the development of the Advanced Turboprop engine was recognized for its achievements. This program was initiated in an attempt to achieve fast, and cost effective air flight in light of the energy crisis of the 1970's and 80's. With the use of super computers and computer-generated design codes the program progressed to investigate propeller aerodynamics, to attempt to reduce the noise generated from propellers. Two problems surfaced for the program: (1) the public perception that development of advanced turbo prop engine was not a step forward, and (2) the eventual relative decrease in fuel prices lessened the requirement.
CASI
Computer Aided Design; Noise Reduction; Propeller Noise; Rotor Aerodynamics; Turboprop Engines; Awards; NASA Programs

19990025649 Air Force Research Lab., Propulsion Directorate, Wright-Patterson AFB, OH USA

High Cycle Fatigue (HCF) Science and Technology Program ***Annual Report, 1 Jan. - 31 Dec. 1998***

Jan. 1999; 131p; In English

Contract(s)/Grant(s): F33615-98-C-2807; AF Proj. APPL

Report No.(s): AD-A359294; AFRL-PR-WP-TM-1998-2148; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This second annual report of the National Turbine Engine High Cycle Fatigue (HCF) Program is a brief review of work completed, work in progress, and technical accomplishments. This program is a coordinated effort with participation by the Air Force, the NavAir Force, the Navy, and NASA. The technical efforts are organized under seven Action Teams including: Materials Damage Tolerance Research, Forced Response Prediction, Component Analysis, Instrumentation, Passive Damping Technology, Component Surface Treatments, and Aeromechanical Characterization. Daniel E. Thornson, AFRL/PRTC, Wright-Patterson AFB, is the Program Manager.

DTIC

Research and Development; Surface Treatment; Technologies; Tolerances (Mechanics)

19990025983 Ohio Aerospace Inst., Cleveland, OH USA

MoSi2-Base Hybrid Composite Passed Engine Test ***Final Report, 1 May - 17 Jul. 1998***

Keith, Theo G., Jr., Ohio Aerospace Inst., USA; Hebsur, Mohan, Ohio Aerospace Inst., USA; December 1998; 3p; In English

Contract(s)/Grant(s): NCC3-621; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The intermetallics compound molybdenum disilicide (MoSi2) is an attractive high-temperature structural material for advanced engine applications. It has excellent oxidation resistance, a high melting point, relatively low density, and high thermal conductivity, and it is easily machined. Past research'at the NASA Lewis Research Center has resulted in the development of a hybrid composite consisting of a MoSi2 matrix reinforced with silicon nitride (Si3N4) Particulate and silicon carbide (SiC) fibers. This composite has demonstrated attractive strength, toughness, thermal fatigue, and oxidation resistance, including resistance to "pest" oxidation. These properties attracted the interest of the Office of Naval Research and Pratt & Whitney, and a joint NASA/Navy/Pratt & Whitney effort was developed to continue to mature the MoSi2 Composite technology. A turbine blade outer air seal, which was part of the Integrated High Performance Turbine Engine Technology (IHPTET) program, was chosen as a first component on which to focus. The first tasks of the materials development effort were to develop improved processing methods to reduce costs and to use fine-diameter fibers that enable the manufacturing of complex shapes. Tape-casting methods were developed to fully infiltrate the fine SiC fibers with matrix powders. The resulting composites were hot pressed to 100-percent density. Composites with cross-plied fiber architectures with 30 vol. % hi-nicalon SiC fibers and 30 vol. % nitride particles are now made routinely and demonstrate a good balance of properties. The next task entailed the measurement of a wide variety of mechanical properties to confirm the suitability of this composite in engines. In particular, participants in this effort demonstrated that composites made with Hi-Nicalon fibers had strength and toughness properties equal to or better than those of the composites made with the large-diameter fibers that had been used previously. Another critically important property measured was impact resistance. Aircraft engine components require sufficient toughness to resist manufacturing defects, assembly damage, stress concentrations at notches, and foreign object damage. Engine company designers indicated that impact resistance would have to be measured before they would seriously consider these types of composites. The Charpy V-notch test was chosen to assess impact resistance, and both monolithic and composite versions Of MOSi2 were tested from -300 to 1400 C. The results (see the following graphs) show that nitride-particulate-reinforced MoSi2 exhibited impact resistance higher than that of many monolithic ceramics and intermetallics, and that the fiber-reinforced composites had even higher values, approaching that of cast superalloys.

Author

Intermetallics; Molybdenum Compounds; Cast Alloys; Charpy Impact Test; Engine Parts; Engine Tests; Fatigue (Materials); Fiber Composites; Impact Damage; Impact Resistance

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.

19990025985 NASA Langley Research Center, Hampton, VA USA
A Control Law Design Method Facilitating Control Power, Robustness, Agility, and Flying Qualities Tradeoffs: CRAFT
Murphy, Patrick C., NASA Langley Research Center, USA; Davidson, John B., NASA Langley Research Center, USA; Sep. 1998; 44p; In English
Contract(s)/Grant(s): RTOP 505-68-30-05
Report No.(s): NASA/TP-1998-208463; L-17571; NAS 1.60:208463; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A multi-input, multi-output control law design methodology, named ”CRAFT”, is presented. CRAFT stands for the design objectives addressed, namely, Control power, Robustness, Agility, and Flying Qualities Tradeoffs. The methodology makes use of control law design metrics from each of the four design objective areas. It combines eigenspace assignment, which allows for direct specification of eigenvalues and eigenvectors, with a graphical approach for representing the metrics that captures numerous design goals in one composite illustration. Sensitivity of the metrics to eigenspace choice is clearly displayed, enabling the designer to assess the cost of design tradeoffs. This approach enhances the designer’s ability to make informed design tradeoffs and to reach effective final designs. An example of the CRAFT methodology applied to an advanced experimental fighter and discussion of associated design issues are provided.
Author
Control Theory; Eigenvalues; Eigenvectors; Flight Control; Thrust Vector Control; Fighter Aircraft; Aerodynamic Characteristics

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).

19990025633 Jefferson (Thomas) National Accelerator Facility, Newport News, VA USA
The Transonic Wind Tunnel and the NACA Technical Culture, Chapter 4
Corneliussen, Steven T., Jefferson (Thomas) National Accelerator Facility, USA; From Engineering Science to Big Science: The NACA and NASA Collier Trophy Research Project Winners; 1998, pp. 91-133; In English; ISBN 0-16-049640-3; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

When the USA began expanding a national effort in applied aeronautical research during the 1920’s a new research tool was required. In 1951, the Collier Trophy was awarded to the engineers and aeronautical researchers of the National Advisory Committee for Aeronautics for the new transonic wind tunnels. This award was an important recognition of the importance of research tools in aeronautics. Until then the award had gone, almost exclusively, to advances in aeronautics such as aircraft, air operations, heroic flights and new airplanes, rather than the research tools which had made the other advances possible.
CASI
Transonic Wind Tunnels; Wind Tunnel Walls; Slotted Wind Tunnels; Scale Effect

19990025653 Science Applications International Corp., Arlington, VA USA
Heliport Lighting: Technology Research *Final Report*
Kimberlin, Ralph D.; Sims, J. P.; Bailey, Thomas E.; Nov. 1998; 45p; In English; Prepared in cooperation with Univ. of Tennessee Space Institute, Tullahoma, TN 37388.
Contract(s)/Grant(s): DTFA01-93-C-00030
Report No.(s): AD-A359316; DOT/FAA/ND-98/1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This document reports on the initial phase of a program to develop a cost-effective heliport lighting system for Global Positioning System (GPS) helicopter approaches. The investigation into lighting technologies shows that many of the currently available technologies would be effective. These include: electroluminescent panels, light pipes or bars, strobes, cold cathode strobes, identification beacons and point light sources. Results showed that furture experiments with helicopter GPS approach lighting arrays should refine the geometric pattern of the light sources, the spacing of the light sources, the direction of the light line, the

intensity of the light source, the color of the light source, the pulse duration for any strobing lights, and the potential use of special types of lights and filters. Additionally, the light sources should contrast with background lights. Line-up and glideslope lights should provide a sufficient visual angle disparity to cue off-course conditions and the required correction.
DTIC
Global Positioning System; Pulse Duration; Point Sources; Luminous Intensity; Light Sources; Illuminating; Heliports; Helicopters

19990025660 NYMA, Inc., Brook Park, OH USA
Flow Field Surveys of the NASA Lewis Research Center 8- by-6-Foot Supersonic Wind Tunnel (1993 Test) ***Final Report***
Arrington, E. Allen, NYMA, Inc., USA; December 1998; 37p; In English
Contract(s)/Grant(s): NAS3-27186; RTOP 523-91-13
Report No.(s): NASA/CR-1998-206610; E-11146; NAS 1.26:206610; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An abbreviated program was conducted in the NASA Lewis Research Center 8- by 6-Foot Supersonic Wind Tunnel to calibrate the test section and survey the flow quality following the installation of flow quality improvements in the facility. This program was designed to accommodate the specific requirements of an aeropropulsion research test program that took place before a complete test section calibration was conducted. Therefore, the flow quality goals for the 8- by 6-ft test section were based on the specific requirements of the research program and the facility's operational constraints. Test results indicate that flow quality in the test section was good and met or exceeded the agreed-upon goals at all except the Mach 2 setting.
Author
Wind Tunnel Tests; Supersonic Wind Tunnels; Supersonic Speed; Flow Distribution; Shock Tunnels; Superharmonics

19990025756 General Accounting Office, Resources, Community and Economic Development Div., Washington, DC USA
Airport Improvement Program: FAA Complying with Requirements for Local Involvement in Noise Mitigation Projects
Dec. 1998; 11p; In English; Report to the Honorable Adam Smith, House of Representatives.
Report No.(s): AD-A359053; GAO/RCED-99-41; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Airports are responsible for controlling the impacts of aircraft noise by mitigating its effects in the immediate vicinity. Through the Airport Improvement Program (AIP), the Federal Aviation Administration (FAA) provides grants for such mitigation efforts. As a condition of receiving AlP grants, airport owners sign a series of assurances that the funds will be spent according to pertinent laws, regulations, or administrative policies. Under FAA policy, one of these grant assurances calls for an airport owner to obtain from each city, county, municipality, or other agency that has control or authority over property affected by the grant a written declaration stating that the project is reasonably consistent with local plans and has local support. Complying with this policy has been an issue at the Seattle-Tacoma International Airport, where some local groups opposed to the airport's expansion have criticized the airport's noise mitigation program and have pointed out that FAA did not require the airport to obtain written declarations that the project was consistent with local plans and had local support. Concerned about the level of consultation that occurs between affected communities and the airport, you asked us to determine whether FAA must enforce this grant assurance as a condition of providing noise mitigation grants to the Seattle-Tacoma International Airport, which is operated by the Port of Seattle.
DTIC
Aircraft Noise; Airports; Cities

19990025915 Federal Aviation Administration, Technical Center, Atlantic City, NJ USA
Airport Surveillance Radar Model 11 (ASR-11) FAA Test and Evaluation Master Plan (TEMP)
Weber, Ronald; Schanne, Joseph; Feb. 1998; 92p; In English
Report No.(s): AD-A359390; DOT/FAA/CT-TN97/27; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The Airport Surveillance Radar, Model 11 (ASR-11) is a joint Federal Aviation Administration (FAA)/Department of Defense (DoD) procurement program with the USA Air Force (USAF) assuming overall lead responsibility. The DoD has designated their program as the Digital Airport Surveillance Radar (DASR). A joint FAA/DoD Test and Evaluation (T&E) program will be conducted in order to support a joint production decision. A Memorandum of Agreement (MOA) between the two agencies defines overall roles and responsibilities for each agency in accomplishing this effort. This ASR-11 Test and Evaluation Master Plan (TEMP) provides an overview of the joint FAA/DoD test program. It outlines the approach and philosophy to be implemented by the FAA to ensure that all FAA test requirements are met. It assigns responsibilities for each T&E phase, defines requirements for test readiness and acceptance, and identifies how each critical issue and major systems requirement will be tested. The FAA

test program outlined in this TEMP will be accomplished in accordance with the Acquisition Management System (AMS) T&E Process Guidelines.
DTIC
Digital Radar Systems; Management Systems; Surveillance Radar; Radar Equipment

19990026257 NASA Ames Research Center, Moffett Field, CA USA
Improving Large-Scale Testing Capability by Modifying the 40- by 80-ft Wind Tunnel
Mort, Kenneth W., NASA Ames Research Center, USA; Soderman, Paul T., Army Aviation Research and Development Command, USA; Eckert, William T., Army Aviation Research and Development Command, USA; Journal of Aircraft; August 1979; Volume 16, No. 8, pp. 571-575; In English; V/STOL, 6-8 Jun. 1977, Moffett Field, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 77-587R; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Interagency studies conducted during the last several years have indicated the need to Improve full-scale testing capabilities. The studies showed that the most effective trade between test capability and facility cost was provided by re-powering the existing Ames Research Center 40- by 80-ft Wind Tunnel to Increase the maximum speed from about 100 m/s (200 knots) lo about 150 m/s (300 knots) and by adding a new 24- by 37-m (80- by 120-ft) test section powered for about a 50-m/s (100-knot) maximum speed. This paper reviews the design of the facility, a few or its capabilities, and some of its unique features.
Author
Wind Tunnels; Improvement; Test Facilities

19990026609 Federal Aviation Administration, Technical Center, Atlantic City, NJ USA
The Interim Runway Visual Range/Automated Surface Observing System Interface Instruction and Operational User Guide
Benner, William; McKinney, Michael; Jones, Michael; Mar. 1998; 42p; In English; Prepared in collaboration with Raytheon Service Co., Burlington, MA.
Report No.(s): AD-A359839; DOT/FAA/CT-TN98/3; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Interim Runway Visual Range/Automated Surface Observing System Interface (Interim RVR/ASOS Interface) Instruction and Operational User Guide is intended to inform users of Interim RVR/ASOS Interface performance features. It is designed to allow users to become familiar with proper use of the interface to facilitate data transfer from the New Generation RVR System to the ASOS at required locations. Successful operation of the interface will enable automated Long-Line RVR service from equipped ASOSs. After reading this guide, users should be able to properly install, configure, start, and stop operation of the interface as well as trouble-shoot most problems that may occur during use. The guide is typically packaged as part of a kit containing equipment and accessories for unaided installation by airport technicians. As of January 31, 1998, operation of the interface exists at seven international airports including: Los Angeles, CA; Denver, CO; Chicago, IL; Portland, OR; Nashville, TN; Seattle, WA; and San Francisco, CA. Federal Aviation Administration (FAA) plans include installation and operation of the interface at approximately 110 airports throughout the U.S. Current system requirements for installation of the interface are: (1) New Generation RVR National Deployment Baseline version software; and (2) ASOS software version 2.49.
DTIC
Runways; Airports; Navigation Aids

19990026610 Federal Aviation Administration, Technical Center, Atlantic City, NJ USA
Interim Runway Visual Range (RVR)/Automated Surface Observing System (ASOS) Interface Regression Operational Test and Evaluation (OT and E) Report
Benner, William; McKinney, Michael; Jones, Michael; Aug. 1998; 50p; In English; Prepared in collaboration with Raytheon Service Co., Burlington, MA.
Report No.(s): AD-A359840; DOT/FAA/CT-TN98/14; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report details results of a regression test performed on the Interim Runway Visual Range (RVR)/Automated Surface Observing System (ASOS) Interface. Testing was conducted from January 21 through 23, 1997, at Memphis International Airport (MEM). Testing was intended to determine if modifications to the interface corrected problems observed during initial testing October of 1996. Testing also was designed to determine if Interim RVR/ASOS software performance enhancements operated in accordance with user needs and functions. Problems observed during the initial test included the following: (1) ASOS Display Screen Mismatch with RVR product, (2) Interim RVR/ASOS Interface Boot Failure, (3) Interim RVR/ASOS Software Lock-Up, (4) New Generation RVR Output Rate and Interim RVR/ASOS Interface Software synchronization, (5) Phantom RVR products with RVR Configuration Modifications, and (6) False RVR products during RVR Sensor Calibration. of the problems discovered

zpduring initial testing, nine were resolved as a result of modifications to the Interim RVR/ASOS Interface and the ASOS. It was determined that a maintenance procedure could be used to correct the remaining problem. Correction and resolution of the problems identified during initial Operational Test and Evaluation (OT&E) indicate the Interim RVR/ASOS Interface and ASOS RVR functions are suitable for use in the field from an operational perspective. Proper performance demonstrated by the Interim RVR/ASOS Interface self-restart and illegal entry prevention features also indicate the Interim RVR/ASOS Interface can be used with a minimum of maintenance actions by field technicians. These developments suggest the Interim RVR/ASOS Interface is prepared for use at designated Long-Line RVR sites. As a result, ACT-320 recommends deployment of the interface at sites designated by the National Weather Service (NWS) and Federal Aviation Administration (FAA).
DTIC
Runways; Navigation Aids; Airports; Software Engineering

19990026611 Federal Aviation Administration, Technical Center, Atlantic City, NJ USA
Interim Runway Visual Range (RVR) Automated Surface Observing System (ASOS) Interface Operational Test and Evaluation (OT&E) Regression Test Number 2 Report
Benner, William; McKinney, Michael; Jones, Michael; Aug. 1998; 34p; In English; Prepared in collaboration with Raytheon Service Co., Burlington, MA.
Report No.(s): AD-A359841; DOT/FAA/CT-TN98/7; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report discusses results of a regression test performed on the Interim Runway Visual Range (RVR)/Automated Surface Observing System (ASOS) Interface. Testing was conducted from September 29, 1997, to October 13,1997, at Memphis International Airport. This was the second regression test performed on the interface following modifications to the RVR-ASOS executable, which operates on the Hewlett Packard Palmtop Personal Computer (HP Palmtop PC). Regression Test #2 was primarily intended to determine if the HP Palmtop RVR-ASOS executable would accurately calculate Long-Line RVR data during various configurations and combinations of New Generation RVR data. Proper ingestion and Display of Long-Line RVR products were also confirmed on ASOS display screens. Test results indicate the custom HP Palmtop software accurately calculated Long-Line RVR readings during the conducted test scenarios. Proper ingestion and display of Long-Line RVR data were confirmed on the ASOS. Results also indicate several problems found during previous OT&E tests were corrected from software modifications to the HP Palmtop and the ASOS. These results suggest the Interim RVR/ASOS Interface is suitable for field deployment and usage. Despite the performance improvements observed, four problems were documented during testing. Three problems related to operation of the ASOS and one concerned operation of the HP Palmtop. Since it is anticipated the observed problems will not impact normal operation of the Interim RVR/ASOS Interface or ASOS, ACT-320 recommends deployment at locations designated by the Federal Aviation Administration (FAA) and the National Weather Service (NWS).
DTIC
Airports; Runways; Navigation Aids; Software Engineering

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ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see 91 Lunar and Planetary Exploration.

19990025327 Massachusetts Inst. of Tech., Lincoln Lab., Lexington, MA USA
A Case Study of Debris Characterization by Remote Sensing
Sridharan, R., Massachusetts Inst. of Tech., USA; Beavers, W. I., Massachusetts Inst. of Tech., USA; Gaposchkin, E. M., Massachusetts Inst. of Tech., USA; Lambour, R. L., Massachusetts Inst. of Tech., USA; Kansky, J. E., Massachusetts Inst. of Tech., USA; Dec. 18, 1998; 54p; In English
Contract(s)/Grant(s): F19628-95-C-0002
Report No.(s): AD-A359035; TR-1045; ESC-TR-97-098; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Analysis of orbital debris data has revealed a band of anomalously high debris concentration between 800 Km, and 1000 Km, altitudes. Detective work by NASA has shown the likely origin to be leaking coolant fluid from nuclear power sources that powered a now defunct Soviet space-based series of ocean surveillance satellites. A project has been in progress at MIT Lincoln Laboratory to detect, track and characterize a small sample of the anomalous debris. The primary sensors used for the purpose are the Haystack radar, the Millstone hill radar, TRADEX and the Firepond optical observatory. The major question addressed was - can

we infer the composition of the material the droplets are made of? The techniques being used to detect, track and characterize the sample set will be described in this report. Results of the characterization analysis will also be presented.
DTIC
Remote Sensing; Search Radar; Earth Orbits; Space Debris; Aerospace Environments

19990025459 NASA Langley Research Center, Hampton,VA USA
International Space Station Attitude Control and Energy Storage Experiment: Effects of Flywheel Torque
Roithmayr, Carlos M., NASA Langley Research Center, USA; Feb. 1999; 20p; In English
Contract(s)/Grant(s): RTOP 430-00-01
Report No.(s): NASA/TM-1999-209100; L-17795; NAS 1.15:209100; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Attitude Control and Energy Storage Experiment is currently under development for the International Space Station; two counter-rotating flywheels will be levitated with magnetic bearings and placed in vacuum housings. The primary objective of the experiment is to store and discharge energy, in combination with existing batteries, into the electrical power system. The secondary objective is to use the flywheels to exert torque on the Station; a simple torque profile has been designed so that the Station's Control Moment Gyroscopes will be assisted in maintaining torque equilibrium attitude. Two energy storage contingencies could result in the inadvertent application of torque by the flywheels to the Station: an emergency shutdown of one flywheel rotor while the other remains spinning, and energy storage with only one rotor instead of the counterrotating pair. Analysis of these two contingencies shows that attitude control and the microgravity environment will not be adversely affected.
Author
Flywheels; Attitude (Inclination); Attitude Control; Energy Storage; Torque; International Space Station

19990025626 Aerospace Corp., Study Team, El Segundo, CA USA
Future Spacelift Requirements Study
August 1997; 512p; In English; Original contains color illustrations
Contract(s)/Grant(s): F04701-93-C-0094
Report No.(s): ATR-97(2157)-1; No Copyright; Avail: CASI; A22, Hardcopy; A04, Microfiche

This study addresses future space applications and the derived requirements these potential applications will have on future spacelift systems. This NASA sponsored activity is a comprehensive study of potential missions including those of the military, civil, and commercial users. The study objectively evaluated the key architectural requirements for future launch systems. The results of this study are technical, economic, and policy analyses of future spacelift systems. It is intended to assist NASA and DOD decision-makers in planning technical investments and establishing policy for future U.S. spacelift systems.
Author
Spacecraft Launching; Space Missions; Space Transportation; Technology Utilization; Technology Assessment

19990026087 Colorado Univ., Dept.of Aerospace Engineering Sciences, Boulder, CO USA
Basic Research in Orbital Debris Detection and Estimation ***Final Report***
Culp, Robert D., Colorado Univ., USA; Jan. 31, 1999; 3p; In English
Contract(s)/Grant(s): NAG9-868; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The research conducted under NASA Research Grant has been reported periodically throughout the duration of this grant. This research has been coordinated with the work supported by NASA Graduate Student Research Grant awarded to further the graduate doctoral program of Kira Jorgensen. This work will continue through the completion of Kira Jorgensen's Ph.D. program in May, 2000.
Author
Detection; Estimating; Space Debris

19990026431 NASA, Washington, DC USA
NASA Technology Plan 1998
1998; 256p; In English
Report No.(s): NASA/NP-1998-12-245-HQ; NAS 1.83:12-245-HQ; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

This NASA Strategic Plan describes an ambitious, exciting vision for the Agency across all its Strategic Enterprises that addresses a series of fundamental questions of science and research. This vision is so challenging that it literally depends on the success of an aggressive, cutting-edge advanced technology development program. The objective of this plan is to describe the

NASA-wide technology program in a manner that provides not only the content of ongoing and planned activities, but also the rationale and justification for these activities in the context of NASA's future needs. The scope of this plan is Agencywide, and it includes technology investments to support all major space and aeronautics program areas, but particular emphasis is placed on longer term strategic technology efforts that will have broad impact across the spectrum of NASA activities and perhaps beyond. Our goal is to broaden the understanding of NASA technology programs and to encourage greater participation from outside the Agency. by relating technology goals to anticipated mission needs, we hope to stimulate additional innovative approaches to technology challenges and promote more cooperative programs with partners outside NASA who share common goals. We also believe that this will increase the transfer of NASA-sponsored technology into nonaerospace applications, resulting in an even greater return on the investment in NASA.
Derived from text
NASA Programs; Project Planning; Project Management

13
ASTRODYNAMICS

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

19990025657 NASA Goddard Space Flight Center, Greenbelt, MD USA
The Use of Laser Altimetry in the Orbit and Attitude Determination of Mars Global Surveyor
Rowlands, D. D., NASA Goddard Space Flight Center, USA; Pavlis, D. E., Raytheon STX Corp., USA; Lemoine, F. G., NASA Goddard Space Flight Center, USA; Neumann, G. A., NASA Goddard Space Flight Center, USA; Luthcke, S. B., Raytheon STX Corp., USA; Geophysical Research Letters; 1999; 7p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Altimetry from the Mars Observer Laser Altimeter (MOLA) which is carried on board Mars Global Surveyor (MGS) has been analyzed for the period of the MOS mission known as Science Phasing Orbit 1 (SPO-1). We have used these altimeter ranges to improve orbit and attitude knowledge for MGS. This has been accomplished by writing crossover constraint equations that have been derived from short passes of MOLA data. These constraint equations differ from traditional Crossover constraints and exploit the small foot print associated with laser altimetry.
Author
Laser Altimeters; Altimeters; Altimetry; Mars Observer; Orbit Calculation

19990025961 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Orbit Determination from Visual Sightings: An Investigation of Two Angles-Only Orbit Determination Processes Including a Science Activity for Middle and High School Students
Dewald, Lee S., Jr; Oct. 26, 1998; 51p; In English
Report No.(s): AD-A358890; AFIT-98-029; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This project will investigate the possibilities of determining the orbit of a satellite from the data obtained by observing the satellite passing across the sky. With simple tools such as a stopwatch, compass, and star map or camera, I believe that the orbit of a satellite may be determined by an angles only approach. In addition, young students, of middle school age and older, could be exposed to the fundamentals of orbital mechanics by conducting such an activity. The calculations required to complete this activity will be manipulated into a coded algorithm. This enables the user to enter information which they retrieved during the satellite pass and get back the calculated orbit of the satellite which they observed. This data could then be used to predict future passes of that satellite. This paper will contain a science activity to aid in teaching the fundamentals of orbital mechanics to middle school students. In addition, it will contain a detailed list of instructions for determining when a satellite will be visible to a user's location, as well as how to obtain pertinent data while observing a satellite pass.
DTIC
Algorithms; Education; Orbital Mechanics; Position (Location); Orbit Calculation

19990026575 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Stability Analysis of Three-Dimensional Hypersonic Entry-Like Trajectories
deOliceFerreira, Leonardo, Instituto Nacional de Pesquisas Espacias, Brazil; deAlmeidaPrado, Antonio Fernando Bertachini, Instituto Nacional de Pesquisas Espacias, Brazil; Vinh, N. X., Michigan Univ., USA; 1998; 7p; In English; 2nd; Aerospace, 31 Aug. - 5 Sep. 1997, Moscow, Russia
Contract(s)/Grant(s): CNPq-300944/96-9
Report No.(s): INPE-6722-PRE/2744; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper is a study on the analysis of three-dimensional hypersonic entry-like trajectories. In order to understand the stability, the paper analyzes three-dimensional, non thrusting, single-pass, short-range lifting skip trajectories. The equation governing the reference trajectory were first nondimensionalized. A combination of the first-order regular perturbation theory and Lyapunov's first theorem was applied to the dimensionless equations.
CASI
Reentry Trajectories; Stability Tests; Unsteady Aerodynamics; Aerodynamic Stability; Hypersonic Vehicles; Equations of Motion; Aerospace Vehicles

14
GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

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

19990025234 NASA Goddard Space Flight Center, Greenbelt, MD USA
Refurbishment and Automation of Thermal Vacuum Facilities at NASA/GSFC
Dunn, Jamie, NASA Goddard Space Flight Center, USA; Gomez, Carlos, NASA Goddard Space Flight Center, USA; Donohue, John, NASA Goddard Space Flight Center, USA; Johnson, Chris, ManTech Systems Engineering Corp., USA; Palmer, John, ManTech Systems Engineering Corp., USA; Sushon, Janet, ManTech Systems Engineering Corp., USA; 1998; 4p; In English; 20th; Space Simulation, 27-29 Oct. 1998, Annapolis, MD, USA
Report No.(s): NASA/CR-1998-208598; NAS 1.26:208598; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The thermal vacuum facilities located at the Goddard Space Flight Center (GSFC) have supported both manned and unmanned space flight since the 1960s. Of the eleven facilities, currently ten of the systems are scheduled for refurbishment or replacement as part of a five-year implementation. Expected return on investment includes the reduction in test schedules, improvements in safety of facility operations, and reduction in the personnel support required for a test. Additionally, GSFC will become a global resource renowned for expertise in thermal engineering, mechanical engineering, and for the automation of thermal vacuum facilities and tests. Automation of the thermal vacuum facilities includes the utilization of Programmable Logic Controllers (PLCs), the use of Supervisory Control and Data Acquisition (SCADA) systems, and the development of a centralized Test Data Management System. These components allow the computer control and automation of mechanical components such as valves and pumps. The project of refurbishment and automation began in 1996 and has resulted in complete computer control of one facility (Facility 281), and the integration of electronically controlled devices and PLCs in multiple others.
Author
Thermal Vacuum Tests; Data Management; Manned Space Flight; Management Systems; Systems Engineering

16
SPACE TRANSPORTATION

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

19990025559 NASA Johnson Space Center, Houston, TX USA
STS-81 Post Flight Presentation
Feb. 16, 1997; In English; Videotape: 41 min. 45 sec. playing time, in color, with sound
Report No.(s): JSC-1623; No Copyright; Avail: CASI; A02, Videotape-VHS; A22, Videotape-Beta

The flight crew of the STS-81 mission, Commander Michael A. Baker, Pilot Brent W. Jett Jr, and Mission Specialists John M. Grunsfeld, Marsha S. Ivins, Peter J.K. Wisoff, and Jerry M. Linenger present a video mission over-view of their space flight. Images include prelaunch activities such as eating the traditional breakfast, crew suit-up, and the ride out to the launch pad. Also included are various panoramic views of the shuttle on the pad. The crew can be seen being readied in the "white room" for their mission. After the closing of the hatch and arm retraction, launch activities are shown including countdown, engine ignition, launch, and the separation of the Solid Rocket Boosters. During the presentation the astronauts take turns discussing aspects of the mission including: the SPACEHAB a double module that provides additional middeck locker space for secondary experi-

ments. During the five days of docked operations with Mir, the crews is seen transferring water and supplies from one spacecraft to the other.
CASI
Space Transportation System Flights; Space Shuttles; Space Shuttle Payloads; Space Shuttle Orbiters; Space Shuttle Missions; Payload Retrieval (STS); Booster Rocket Engines; Flight Crews; Spacecraft Modules; Spacecrews

19990025579 NASA Johnson Space Center, Houston, TX USA
STS-95 Post Flight Presentation
Dec. 16, 1998; In English; Videotape: 42 min. 34 sec. playing time, in color, with sound
Report No.(s): JSC-1760; No Copyright; Avail: CASI; A02, Videotape-VHS; A22, Videotape-Beta

The STS-95 flight crew, Cmdr. Curtis L. Brown, Pilot Steven W. Lindsey, Mission Specialists Scott E. Parazynski, Stephen K. Robinson, and Pedro Duque, and Payload Specialists Chiaki Mukai and John H. Glenn present a video mission over-view of their space flight. Images include prelaunch activities such as eating the traditional breakfast, crew suit-up, and the ride out to the launch pad. Also, included are various panoramic views of the shuttle on the pad. The crew can be seen being readied in the ”white-room” for their mission. After the closing of the hatch and arm retraction, launch activities are shown including countdown, engine ignition, launch, and the separation of the Solid Rocket Boosters. The primary objectives, which include the conducting of a variety of science experiments in the pressurized SPACEHAB module, the deployment and retrieval of the Spartan free-flyer payload, and operations with the HST Orbiting Systems Test (HOST) and the International Extreme Ultraviolet Hitchhiker (IEH) payloads are discussed in both the video and still photo presentation.
CASI
Space Transportation System Flights; Spacecrews; Payloads; Launching; Space Flight; Space Shuttles; International Space Station; Manned Space Flight

19990025580 NASA Johnson Space Center, Houston, TX USA
STS-88 Crew Interview: Frederick ”Rick” Sturckow
Dec. 17, 1998; In English; Videotape: 26 min. playing time, in color, with sound
Report No.(s): JSC-1748B; No Copyright; Avail: CASI; A02, Videotape-VHS; A22, Videotape-Beta

Frederick Sturckow discusses the seven-day mission that will be highlighted by the mating of the U.S.-built Node 1 station element to the Functional Energy Block (FGB) which will already be in orbit, and two spacewalks to connect power and data transmission cables between the Node and the FGB. Node 1 will be the first Space Station hardware delivered by the Space Shuttle. He also disscusses the assembly sequence. The crew will conduct a series of rendezvous maneuvers similar to those conducted on other Shuttle missions to reach the orbiting FGB. Once the two elements are docked, Ross and Newman will conduct two scheduled spacewalks to connect power and data cables between the Node, PMAs and the FGB. The day following the spacewalks, Endeavour will undock from the two components, completing the first Space Station assembly mission.
CASI
Space Shuttle Missions; Space Shuttles; International Space Station; Unity Connecting Module; Zarya Control Module; Large Space Structures; International Cooperation

19990025582 George Washington Univ., Center for International Science and Technology, Washington, DC USA
Return to Flight: Richard H. Truly and the Recovery from the Challenger Accident, Chapter 15
Logsdon, John M., George Washington Univ., USA; From Engineering Science to Big Science: The NACA and NASA Collier Trophy Research Project Winners; 1998, pp. 345-364; In English; ISBN 0-16-049640-3; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

After the explosion of the Space Shuttle Challenger in 1986, there was a thirty two month period during which there were no launchings. Presiding over the return to flight effort for all but one of those 32 months was Rear Admiral Richard H. Truly. In 1988 the Collier trophy was awarded to Truly for his ”outstanding leadership in the direction of the recovery of the nation’s manned space program.” This essay recounted the managerial and technological challenges of the return-to-flight effort, with particular emphasis on the role which Truly played. The Rogers Commission, charged to investigate the accident, resulted in several interrelated recommendations. They involved: (1) fixing the Solid Rocket Motor, (2) creating a new management structure, (3) making other changes to the shuttle, (4) adding a escape system, and (5) setting an appropriate flight schedule.
CASI
Accidents; Challenger (Orbiter); Leadership; Solid Propellant Rocket Engines; Space Shuttle Mission 51-L

19990025585 Texas A&M Univ., History Dept., College Station, TX USA
The Space Shuttle's First Flight: STS-1, Chapter 12
Dethloff, Henry C., Texas A&M Univ., USA; From Engineering Science to Big Science: The NACA and NASA Collier Trophy Research Project Winners; 1998, pp. 277-297; In English; ISBN 0-16-049640-3; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Collier Trophy for 1981 was awarded for the first flight of the space shuttle. This flight marked the culmination of many years of planning and work on the part of NASA and many contractors. The idea of a reusable was not new. It had been around since the 1950's. The thermal protection system had to be designed and tested. The requirements necessitated a very highly sophisticated avionics system. So sophisticated that special laboratories had to be developed to design and test them. Changes in the management structure were also required to reduced costs and to guarantee the success of the program.
CASI
Cost Reduction; Space Shuttle Orbiters; Columbia (Orbiter); Space Transportation System 1 Flight; Awards; Project Management

19990025592 NASA Johnson Space Center, Houston, TX USA
STS-87 Mission Highlights Resources Tape
Dec. 15, 1998; In English; Videotape: 1 hour 28 min. playing time, in color, with sound
Report No.(s): JSC-1698; No Copyright; Avail: CASI; A02, Videotape-VHS; A22, Videotape-Beta

The STS-87 mission the flight crew, Commander Kevin R. Kregel, Pilot Steven W. Lindsey, Mission Specialists Winston E. Scott, Kalpana Chawla, and Takao Doi, and Payload Specialist Leonid K. Kadenyuk present an overview of there mission. STS-87 will fly the USA Microgravity Payload (USMP-4), the Spartan-201, the Orbital Acceleration Research Experiment (OARE), the EVA Demonstration Flight Test 5 (EDFT-05). The objective of the observations are to investigate the mechanisms causing the heating of the solar corona and the acceleration of the solar wind which originates in the corona. While flying separately in the cargo bay, the Orbital Acceleration Research Experiment (OARE) is an integral part of USMP-04. It is a highly sensitive instrument designed to acquire and record data of low-level aerodynamic acceleration along the orbiter's principal axes in the free-molecular flow regime at orbital altitudes and in the transition regime during re-entry. OARE data will support advances in space materials processing by providing measurements of the low-level, low frequency disturbance environment affecting various microgravity experiments. OARE data will also support advances in orbital drag prediction technology by increasing the understanding of the fundamental flow phenomena in the upper atmosphere.
CASI
Space Transportation System Flights; Spacecraft Construction Materials; Payloads; Microgravity; Gravitational Effects; Free Molecular Flow; Extravehicular Activity; Bays (Structural Units); Cargo

19990025624 NASA Johnson Space Center, Houston, TX USA
STS-88 Post Flight Presentation
Dec. 16, 1998; In English; Videotape: 34 min. 10 sec. playing time, in color, with sound
Report No.(s): JSC-1775; No Copyright; Avail: CASI; A02, Videotape-VHS; A22, Videotape-Beta

The flight crew of the STS-88 mission, Commander Robert D. Cabana, Pilot Frederick W. Sturckow, and Mission Specialists Nancy J. Currie, Jerry L. Ross, James H. Newman, and Sergei K. Krikalev, present a video mission over-view of their space flight. Images include prelaunch activities such as eating the traditional breakfast, crew suit-up, and the ride out to the launch pad. Also, included are various panoramic views of the shuttle on the pad. The crew can be seen being readied in the "white room" for their mission. After the closing of the hatch and arm retraction, launch activities are shown including countdown, engine ignition, launch, and the separation of the Solid Rocket Boosters. Once the seven-day mission begins, the astronauts comment on the mating of the U.S.-built Node 1 station element to the Functional Energy Block (FGB) which was already in orbit, and two EVAs that were planned to connect power and data transmission cables between the Node and the FGB. The crew can also be seen conducting a series of rendezvous maneuvers similar to those conducted on other Shuttle missions to reach the orbiting FGB.
CASI
Space Shuttle Missions; Spacecrews; Flight Crews; Extravehicular Activity; Astronauts

19990025625 NASA Johnson Space Center, Houston, TX USA
STS-88 Crew Interview: Nancy Currie
Dec. 17, 1998; In English; Videotape: 30 min. 45 sec. playing time, in color, with sound
Report No.(s): JSC-1748D; No Copyright; Avail: CASI; A02, Videotape-VHS; A22, Videotape-Beta

Nancy Currie discusses the seven-day mission that will be highlighted by the mating of the U.S.-built Node 1 station element to the Functional Energy Block (FGB) which will already be in orbit, and two spacewalks to connect power and data transmission cables between the Node and the FGB. Node 1 will be the first Space Station hardware delivered by the Space Shuttle. He also disscusses the assembly sequence. The crew will conduct a series of rendezvous maneuvers similar to those conducted on other Shuttle missions to reach the orbiting FGB. Once the two elements are docked, Ross and Newman will conduct two scheduled spacewalks to connect power and data cables between the Node, PMAs and the FGB. The day following the spacewalks, Endeavour will undock from the two components, completing the first Space Station assembly mission.
CASI
Space Shuttle Missions; Space Shuttles; International Space Station; Unity Connecting Module; Zarya Control Module; International Cooperation; Extravehicular Mobility Units; Space Transportation System Flights

19990025627 NASA Johnson Space Center, Houston, TX USA
STS-88 Crew Interview: Sergei Krikalev
Dec. 17, 1998; In English; Videotape: 29 min. 30 sec. playing time, in color, with sound
Report No.(s): JSC-1748F; No Copyright; Avail: CASI; A02, Videotape-VHS; A22, Videotape-Beta
Sergei Krikalev discusses the seven-day mission that will be highlighted by the mating of the U.S.-built Node 1 station element to the Functional Energy Block (FGB) which will already be in orbit, and two spacewalks to connect power and data transmission cables between the Node and the FGB. Node 1 will be the first Space Station hardware delivered by the Space Shuttle. He also discusses the assembly sequence. The crew will conduct a series of rendezvous maneuvers similar to those conducted on other Shuttle missions to reach the orbiting FGB. Once the two elements are docked, Ross and Newman will conduct two scheduled spacewalks to connect power and data cables between the Node, PMAs and the FGB. The day following the spacewalks, Endeavour will undock from the two components, completing the first Space Station assembly mission.
CASI
Space Shuttle Missions; Space Shuttles; International Space Station; Zarya Control Module; Unity Connecting Module; Space Station Modules; Large Space Structures

19990025628 NASA Johnson Space Center, Houston, TX USA
STS-88 Crew Interview: Robert Cabana
Dec. 17, 1998; In English; Videotape: 37 min. 15 sec. playing time, in color, with sound
Report No.(s): JSC-1748A; No Copyright; Avail: CASI; A02, Videotape-VHS; A22, Videotape-Beta
Commander Robert D. Cabana discusses the seven-day mission that will be highlighted by the mating of the U.S.-built Node 1 station element to the Functional Energy Block (FGB) which will already be in orbit, and two spacewalks to connect power and data transmission cables between the Node and the FGB. Node 1 will be the first Space Station hardware delivered by the Space Shuttle. He also disscusses the assembly sequence. The crew will conduct a series of rendezvous maneuvers similar to those conducted on other Shuttle missions to reach the orbiting FGB. Once the two elements are docked, Ross and Newman will conduct two scheduled spacewalks to connect power and data cables between the Node, PMAs and the FGB. The day following the spacewalks, Endeavour will undock from the two components, completing the first Space Station assembly mission.
CASI
Space Shuttle Missions; Space Shuttles; International Space Station; Unity Connecting Module; Zarya Control Module; Large Space Structures; International Cooperation

19990025629 NASA Johnson Space Center, Houston, TX USA
STS-88 Crew Interview: Jim Newman
Dec. 17, 1998; In English; Videotape: 42 min. 45 sec. playing time, in color, with sound
Report No.(s): JSC-1748E; No Copyright; Avail: CASI; A02, Videotape-VHS; A22, Videotape-Beta
Jim Newman discusses the seven-day mission that will be highlighted by the mating of the U.S.-built Node 1 station element to the Functional Energy Block (FGB) which will already be in orbit, and two spacewalks to connect power and data transmission cables between the Node and the FGB. Node 1 will be the first Space Station hardware delivered by the Space Shuttle. He also discusses the assembly sequence. The crew will conduct a series of rendezvous maneuvers similar to those conducted on other Shuttle missions to reach the orbiting FGB. Once the two elements are docked, Ross and Newman will conduct two scheduled spacewalks to connect power and data cables between the Node, PMAs and the FGB. The day following the spacewalks, Endeavour will undock from the two components, completing the first Space Station assembly mission.
CASI
Space Shuttle Missions; Space Shuttles; Space Transportation System; International Space Station; Large Space Structures;

Orbital Workshops; Unity Connecting Module; Zarya Control Module

19990025630 NASA Johnson Space Center, Houston, TX USA
STS-88 Crew Interview: Jerry Ross
Dec. 17, 1998; In English; Videotape: 54 min. 30 sec. playing time, in color, with sound
Report No.(s): JSC-1748C; No Copyright; Avail: CASI; A02, Videotape-VHS; A22, Videotape-Beta

Jerry Ross discusses the seven-day mission that will be highlighted by the mating of the U.S.-built Node 1 station element to the Functional Energy Block (FGB) which will already be in orbit, and two spacewalks to connect power and data transmission cables between the Node and the FGB. Node 1 will be the first Space Station hardware delivered by the Space Shuttle. He also disscusses the assembly sequence. The crew will conduct a series of rendezvous maneuvers similar to those conducted on other Shuttle missions to reach the orbiting FGB. Once the two elements are docked, Ross and Newman will conduct two scheduled spacewalks to connect power and data cables between the Node, PMAs and the FGB. The day following the spacewalks, Endeavour will undock from the two components, completing the first Space Station assembly mission.
CASI
Space Shuttle Missions; Space Shuttles; International Space Station; Large Space Structures; International Cooperation; Unity Connecting Module; Zarya Control Module

19990025761 NASA Johnson Space Center, Houston, TX USA
STS-95 Mission Highlights Resources Tape
Jan. 06, 1999; In English; Videotape: 1 hour 25 min. 10 sec. playing time, in color, with sound
Report No.(s): JSC-1761; No Copyright; Avail: CASI; A02, Videotape-VHS; A22, Videotape-Beta

The STS-95 flight crew, Commander Curtis L. Brown, Pilot Steven W. Lindsey, Mission Specialists Scott E. Parazynski, Stephen K. Robinson, and Pedro Duque, and Payload Specialists Chiaki Mukai and John H. Glenn present a video overview of their space flight. They are seen performing pre-launch activities such as eating the traditional breakfast, crew suit-up, and the ride out to the launch pad. Also, included are various panoramic views of the shuttle on the pad. The crew is readied in the 'white room' for their mission. After the closing of the hatch and arm retraction, launch activities are shown including countdown, engine ignition, launch, and the separation of the Solid Rocket Boosters. Once on-orbit the primary objectives include conducting a variety of science experiments in the pressurized SPACEHAB module, the deployment and retrieval of the Spartan free-flyer payload, and operations with the Hubble Space Telescope (HST) Orbiting Systems Test (HOST) and the International Extreme Ultraviolet Hitchhiker (IEH) payloads being carried in the payload bay. Throughout the presentation, the astronauts take turns narrating particular aspects of the mission with which they were involved.
CASI
Discovery (Orbiter); Space Flight; Space Shuttle Boosters; Space Transportation System Flights; Hubble Space Telescope; Payload Retrieval (STS)

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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.

19990025293 NASA Goddard Space Flight Center, Greenbelt, MD USA
Improved Modeling in a Matlab-Based Navigation System
Deutschmann, Julie, NASA Goddard Space Flight Center, USA; Bar-Itzhack, Itzhack, Technion - Israel Inst. of Tech., Israel; Harman, Rick, NASA Goddard Space Flight Center, USA; Larimore, Wallace E., Adaptics, Inc., USA; 1999; 9p; In English; 22nd; Guidance and Control, 3-7 Feb. 1999, Breckenridge, CO, USA; Sponsored by American Astronomical Society, USA
Report No.(s): AAS-99-012; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

An innovative approach to autonomous navigation is available for low earth orbit satellites. The system is developed in Matlab and utilizes an Extended Kalman Filter (EKF) to estimate the attitude and trajectory based on spacecraft magnetometer and gyro data. Preliminary tests of the system with real spacecraft data from the Rossi X-Ray Timing Explorer Satellite (RXTE) indicate the existence of unmodeled errors in the magnetometer data. Incorporating into the EKF a statistical model that describes the colored component of the effective measurement of the magnetic field vector could improve the accuracy of the trajectory and attitude estimates and also improve the convergence time. This model is identified as a first order Markov process. With the addition of the model, the EKF attempts to identify the non-white components of the noise allowing for more accurate estimation

of the original state vector, i.e. the orbital elements and the attitude. Working in Matlab allows for easy incorporation of new models into the EKF and the resulting navigation system is generic and can easily be applied to future missions resulting in an alternative in onboard or ground-based navigation.
Author
Kalman Filters; Low Earth Orbits; Markov Processes; Magnetic Measurement; Magnetic Fields

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SPACECRAFT DESIGN, TESTING AND PERFORMANCE

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

19990025636 University of Eastern New Mexico, Portales, NM USA
The Human Touch: The History of the Skylab Program, Chapter 9
Elder, Donald C., University of Eastern New Mexico, USA; From Engineering Science to Big Science: The NACA and NASA Collier Trophy Research Project Winners; 1998, pp. 213-233; In English; ISBN 0-16-049640-3; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

On February 8, 1974, astronauts Gerald P. Carr, Edward G. Gibson, and William R. Pogue, after an eighty-four-day mission in outer space aboard an orbital laboratory named Skylab, boarded an Apollo command module and returned to earth. Their splashdown marked the end of a venture marking three separate crews that had set twenty-five International Aeronautical Federation world records and had managed to complete ninety major scientific experiments. It therefore surprised no one when two months later the Collier Committee announced that it had selected the Skylab program as the recipient of the 1973 Robert J. Collier Trophy. The official announcement of the award duly noted the importance of ”the production of data of benefit to all the people on Earth”, but had prefaced that praise by asserting that Skylab had proved ”beyond question the value of man in future explorations of space.” The Skylab program, then, had a great immediate impact in aiding the expansion of scientific knowledge, but also offered the long-range benefit of demonstrating the importance of the continuance of the human component in the American space program. This essay examines the history of Skylab. The story begins with the first suggestions for a laboratory in outer space, then turns to a discussion of how such an idea gained official acceptance from the National Aeronautics and Space Administration (NASA). Each of the missions will be considered, and the results they yielded will be assessed. Throughout the story, I will analyze how various groups competed with each other to control the design, timing, and function of the project. Although stressing the role technological innovation played in the eventual success of the Skylab program, I will demonstrate how the human element was crucial at every stage of this ”exceedingly complex enterprise.” Finally, I will suggest the ways in which the program resonated with and still influences the goals and objectives of NASA.
Derived from text
Skylab Program; Histories; Technology Utilization; Skylab 1

19990025939 GenCorp Aerojet, Azusa, CA USA
Uniform Interface for Multiple Satellite Systems Study ***Final Report, 8 May 1997 - 4 Jun. 1998***
Connor, Gloria; Harrell, John F.; Aug. 27, 1998; 46p; In English
Contract(s)/Grant(s): F29601-97-C-0051; AF Proj. 2181
Report No.(s): AD-A359552; 11173; AFRL-VS-PS-TR-1998-1070; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

This report attempts to model a multi-satellite ground telemetry processing system (MSG) for reducing the level of effort associated with extending a system to supporting new satellites. The use of object-oriented (OO) hierarchy and abstraction alone does not sufficiently reduce the inherent complexity of a MSG due to the number and diversity of classes required to support such a system. This approach reduces the potential for multiple branches and layers of subclasses without losing generality and thus maximizes code reuse. The model was developed using ordinary, well documented OO patterns combined with a novel approach for retrieving class attributes external to the source code. A database management system with database and query language capabilities is used for retrieving attributes during system initialization. This allows chaining classes together for building a processing structure without hard-coding anything more than the abstract classes being used.
DTIC
Satellite Networks; Relational Data Bases

19990025954 Swales and Associates, Beltsville, MD USA
Assurance of COTS Boards for Space Flight, Part 1
Plante Jeannette, Swales and Associates, USA; Helmold, Norm, Swales and Associates, USA; Eveland, Clay, Swales and Associates, USA; [1999]; 10p; In English; Commercialization of Military and Space Electronics Workshop, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Space Flight hardware and software designers are increasingly turning to Commercial-Off-the-Shelf (COTS) products in hopes of meeting the demands imposed on them by projects with short development cycle times. The Technology Validation Assurance (TVA) team at NASA GSFC has embarked on applying a method for inserting COTS hardware into the Spartan 251 spacecraft. This method includes Procurement, Characterization, Ruggedization/Remediation and Verification Testing process steps which are intended to increase the user's confidence in the hardware's ability to function in the intended application for the required duration. As this method is refined with use, it has the potential for becoming a benchmark for industry-wide use of COTS in high reliability systems.
Author
Space Flight; Computer Programs; Spacecraft Design; Hardware; Product Development; Software Engineering; Space Industrialization; Space Commercialization; Aerospace Industry

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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.

19990025221 Michigan Univ., Dept. of Aerospace Engineering, Ann Arbor, MI USA
Establishment of a World-Class Facility for High-Power Electric Propulsion Research ***Final Report, 1 Mar. 1992 - 28 Aug. 1998***
Gallimore, Alec D.; Dec. 14, 1998; 18p; In English
Contract(s)/Grant(s): F49620-97-1-0107; AF Proj. 3484
Report No.(s): AD-A359268; AFRL-SR-BL-TR-99-0010; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

DURIP funds were used to purchase a state-of-the-art cryopumping system and a laser induced fluorescence (LIF) system utilizing two lasers (a 20 W UV-capable, argon-ion pump laser used in conjunction with a ring-dye laser) to enhance the vacuum and diagnostics capabilities at the University of Michigan's Plasmadynamics and Electric Propulsion Laboratory (PEPL). Prior to the upgrade, the 9 x 6 meter diffusion-pumped vacuum chamber at PEPL had a xenon pumping speed of 27,000 l/s and could maintain a pressure of 50 microtorr during the operation of a 1.35 kW Hall thruster. The base pressure of the facility was approximately 20 microtorr. The four large nude cryopumps, used in place of the diffusion pumps, and significant leak repair work allows for a 140,000 l/s xenon pumping speed, a base pressure of 20 microtorr, and a clean, oil-free test environment. The facility upgrade, and the addition of LW capability, has made PEPL one of the few world-class electric propulsion test facilities in the nation.
DTIC
Electric Propulsion; Cryopumping; Laser Induced Fluorescence; Diffusion Pumps; Test Facilities

19990025577 Moscow State Univ., Research Inst. of Applied Mechanics and Electrodynamics, Russia
Development of PPT Laboratory Model Which is as Close to the Flight One as Possible ***Final Report***
Antropov, Nikolay, Moscow State Univ., Russia; Jan. 1996; 103p; In English
Contract(s)/Grant(s): F61708-95-W-0336
Report No.(s): AD-A358904; EOARD-SPC-95-4033; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This report results from a contract tasking Research Institute of Applied Mechanics and Electrodynamics as follows: Develop a PPT laboratory model which is as close to the flight one as possible.
DTIC
Propulsion; Fabrication; Models; Rocket Engines

19990025901 Georgia Inst. of Tech., Space Systems Design Lab., Atlanta, GA USA
Launch Vehicle Systems Analysis ***Final Report, 3 Jun. 1996 - 30 Sep. 1998***
Olds, John R., Georgia Inst. of Tech., USA; Jan. 27, 1999; 236p; In English
Contract(s)/Grant(s): NAG8-1302; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

This report summaries the key accomplishments of Georgia Tech's Space Systems Design Laboratory (SSDL) under NASA Grant NAG8-1302 from NASA - Marshall Space Flight Center. The report consists of this summary white paper, copies of technical papers written under this grant, and several viewgraph-style presentations. During the course of this grant four main tasks were completed: (1)Simulated Combined-Cycle Rocket Engine Analysis Module (SCCREAM), a computer analysis tool for predicting the performance of various RBCC engine configurations; (2) Hyperion, a single stage to orbit vehicle capable of delivering 25,000 pound payloads to the International Space Station Orbit; (3) Bantam-X Support - a small payload mission; (4) International Trajectory Support for interplanetary human Mars missions.
Derived from text
Aerospace Systems; International Space Station; Single Stage to Orbit Vehicles; Trajectories; Manned Mars Missions; Low Earth Orbits; Spacecraft Propulsion; Rocket Engines; Technology Transfer

19990025912 Pennsylvania State Univ., Dept.of Mechanical Engineering, University Park, PA USA
Experimental Studies of the Heat Transfer to RBCC Rocket Nozzles for CFD Application to Design Methodologies ***Final Report***
Santoro, Robert J., Pennsylvania State Univ., USA; Pal, Sibtosh, Pennsylvania State Univ., USA; February 1999; 27p; In English
Contract(s)/Grant(s): NASA Order H-29688-D; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Rocket thrusters for Rocket Based Combined Cycle (RBCC) engines typically operate with hydrogen/oxygen propellants in a very compact space. Packaging considerations lead to designs with either axisymmetric or two-dimensional throat sections. Nozzles tend to be either two- or three-dimensional. Heat transfer characteristics, particularly in the throat, where the peak heat flux occurs, are not well understood. Heat transfer predictions for these small thrusters have been made with one-dimensional analysis such as the Bartz equation or scaling of test data from much larger thrusters. The current work addresses this issue with an experimental program that examines the heat transfer characteristics of a gaseous oxygen (GO2)/gaseous hydrogen (GH2) two-dimensional compact rocket thruster. The experiments involved measuring the axial wall temperature profile in the nozzle region of a water-cooled gaseous oxygen/gaseous hydrogen rocket thruster at a pressure of 3.45 MPa. The wall temperature measurements in the thruster nozzle in concert with Bartz's correlation are utilized in a one-dimensional model to obtain axial profiles of nozzle wall heat flux.
Author
Heat Transfer; Rocket Nozzles; Computational Fluid Dynamics; Liquid Cooling; Hydrogen; Oxygen; Propellants

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CHEMISTRY AND MATERIALS (GENERAL)

19990025762 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
Energetics of Cation Radical Formation at the Proximal Active Site Tryptophan of Cytochrome-c-Peroxidase and Ascorbate Peroxidase ***Final Report, Aug. 1996 - Oct. 1997***
Jensen, G. M.; Bunte, S. W.; Warshel, A.; Goodin, D. B.; Dec. 1998; 43p; In English; Prepared in cooperation with The Scripps Research Institute, LaJolla, Ca. and University of Southern California, Ca.
Contract(s)/Grant(s): Proj-1L161102AH43
Report No.(s): AD-A358909; ARL-TR-1859; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Despite very similar protein structures, ascorbate peroxidase (APX) and yeast cytochrome-c-peroxidase (CCP) stabilize different radical species during enzyme turnover. Both enzymes contain similar active site residues, including the tryptophan that is oxidized to a stable cation radical in CCP. However, the analogous trytophan is not oxidized in APX, and the second oxidizing equivalent is retained as a porphyrin pi-cation radical. In this study, we provide an improved computational approach to estimate the contribution of solvent and protein electrostatics to the energetics of tryptophan cation radical formation in the two enzyme environments. The Protein Dipoles Langevin Dipoles (PDLD) model is combined with molecular dynamics to estimate the role of discrete solvation, atomic polarizabilitis, and dynamic motional averaging on the electrostatic potentials. The PDLD model shows that the protein environment of CCP stabilizes the tryptophan cation radical by 330 mV relative to that in APX. Analysis of the components contributing to this difference supports proposals that the cation binding site contributes to, but is not the sole cause of, the different sites of radical stabilization. The enzymes have thus evolved this distinction using several contributing interactions including the cation binding site, solvent access, and subtle differences in protein structure and dynamics.
DTIC
Atoms; Cations; Cytochromes; Electrostatics; Enzymes; Langevin Formula; Molecular Dynamics

19990025784 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Photosynthetic hydrogen and oxygen production by green algae
Greenbaum, E., Department of Energy, USA; Lee, J. W., Department of Energy, USA; Dec. 31, 1997; 16p; In English; BioHydrogen 1997: Biological Hydrogen Production
Report No.(s): DE97-008436; CONF-9706179-1; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

An overview of photosynthetic hydrogen and oxygen production by green algae in the context of its potential as a renewable chemical feed stock and energy carrier is presented. Current research is focused on optimizing net thermodynamic conversion efficiencies represented by the Gibbs Free Energy of molecular hydrogen. The key research questions of maximizing hydrogen and oxygen production by light-activated water splitting in green algae are (1) removing the oxygen sensitivity of algal hydrogenases; (2) linearizing the light saturation curves of photosynthesis throughout the entire range of terrestrial solar irradiance--including the role of bicarbonate and carbon dioxide in optimization of photosynthetic electron transport and (3) the minimum number of light reactions that are required to split water to elemental hydrogen and oxygen.
NTIS
Photosynthesis; Hydrogen; Oxygen; Oxygen Production; Algae; Hydrogen Production

19990025920 Fluorochem, Inc., Azusa, CA USA
Non-Fouling Materials for Submerged Sensors ***Final Report, 6 May 1996 - 21 Jul. 1998***
Baum, Kurt; Jan. 28, 1999; 3p; In English
Contract(s)/Grant(s): N00014-96-C-0100; Proj-
Report No.(s): AD-A359408; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Silicones are effective as non-toxic fouling release marine coatings, but inorganic fillers are usually used to improve their strength. The objectives of this program was to develop a means of improving the strength of silicones that maintains their optical clarity for sensor applications. Hydrosilylation of hydride-terminated polydimethylsiloxane with polybutadiene in dilute solution yielded polysiloxane side-loops. Crosslinking took place on removal of solvent. When the ratio of silane to olefin in the hydrosilylation mixture was increased, the inherent viscosity of the solutions decreased drastically. The results are explained on the basis of diminishing availability of olefin sites as the reaction proceeds. When one end of a difunctional silane attaches to an olefin site and no other olefin sites are available nearby, molecular motion eventually brings a remote olefin site in the molecule into proximity. Hydrosilylation then results in permanent ring folding.
DTIC
Coatings; Silicones; Optical Properties; Crosslinking; Optical Measuring Instruments

19990026126 Department of Energy, Office of Environmental Restoration and Waste Management, Washington, DC USA
Distribution of Fatty Acids and Triethanolamine in Synthetic Metalworking Fluid Aerosols Generated in the Laboratory and Field
Ilgner, R. H., Department of Energy, USA; Dec. 31, 1997; 10p; In English; Industrial Metalworking Environment: Assessment and Control of Metal Removal Fluids, Unknown
Report No.(s): DE98-000702; ORNL/CP-94788; CONF-9709112; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Metalworking fluid mists were generated in the laboratory with selected synthetic fluids by nebulization and with an air sparging apparatus. Short chain fatty acid species were determined in the vapor and particulate phase of the resulting aerosols using in-situ trimethyl silyl derivatization. Certain fatty acid species in sparger generated mists were found in the vapor phase in greater quantities relative to the particle phase, compared with the corresponding amounts determined in nebulized mists. With one metalworking fluid, the nonanoic acid vapor phase to particulate phase concentration ratio was over 14 fold higher with air sparged mists (1.0) than with the corresponding nebulized mists (0.07). The nonanoic acid vapor phase concentrations were 0.026 mg/cu m and 0.002 mg/cu m for sparged (bubbled) and nebulized mists respectively. This phenomenon was observed with mists generated from several selected synthetic metalworking fluids. This could suggest that in the work place environment, with a variety of mist generation mechanisms occurring simultaneously, significant vapor phase concentrations of certain species could exist in an environment where particulate levels are low. Vapor phase fatty acid levels could remain relatively high in an occupational setting even when mist levels are reduced with efficient air cleaning devices. Results from mist generation experiments performed in the laboratory, were compared with actual field data from a relatively clean metal machining operation. Anecdotal evidence of potential irritation by short chain fatty acids prompted a study of this industrial site. Numerous air scrubbing devices were utilized at this industrial site to reduce airborne particulates, which typically ranged from 0.05 to 0.4 mg/cu m. Comparisons were

made of triethanolamine and short chain fatty acid concentrations in vapor and particulate phases measured in the laboratory and work place environment.
NTIS
Aerosols; Air Pollution; Air Purification; Metal Working; Particulates; Vapor Phases

19990026132 Department of Energy, Washington, DC USA
Copper-Catalyzed Decomposition at Diphenylborinic Acid and Phenylboronic Acid
Wilmarth, W. R., Department of Energy, USA; Crawford, C. L., Department of Energy, USA; Peterson, R. A., Department of Energy, USA; Aug. 31, 1997; 12p; In English
Report No.(s): DE98-053167; WSRC-TR-97-0238; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
This report describes studies of the decomposition of diphenylborinic acid and phenylboronic acid at 25 C and 40 C in 1.5 M sodium hydroxide under continuous flowing air.
NTIS
Copper; Decomposition; Catalysis

19990026133 Department of Energy, Office of Environmental Restoration and Waste Management, Washington, DC USA
Sodium Tetraphenylborate Catalyst Identification, Phase D, Statistical Design Studies
Barnes, M. J., Department of Energy, USA; Peterson, R. A., Department of Energy, USA; Sep. 30, 1997; 16p; In English
Report No.(s): DE98-053168; WSRC-TR-97-0275; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
This work supports resolution of DNFSB Recommendation 96-1 and the task seeking to identify the catalyst responsible for NaTPB decomposition in the In-Tank Precipitation facility.
NTIS
Sodium; Catalysts

19990026134 Department of Energy, Office of Environmental Restoration and Waste Management, Washington, DC USA
Excess Sodium Tetraphenylborate and Intermediates Decomposition Studies
Barnes, M. J., Department of Energy, USA; Peterson, R. A., Department of Energy, USA; Apr. 30, 1998; 42p; In English
Report No.(s): DE98-053169; WSRC-TR-98-00099; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The stability of excess amounts of sodium tetraphenylborate (NaTPB) in the In-Tank Precipitation (ITP) facility depends on a number of variables. Concentration of palladium, initial benzene, and sodium ion as well as temperature provide the best opportunities for controlling the decomposition rate. This study examined the influence of these four variables on the reactivity of palladium-catalyzed sodium tetraphenylborate decomposition. Also, single effects tests investigated the reactivity of stimulants with continuous stirring and nitrogen ventilation, with very high benzene concentrations, under washed sodium concentrations, with very high palladium concentrations, and with minimal quantities of excess NaTPB. The testing demonstrates that current facility configuration does not provide assured safety of operations relative to the hazards of benzene (in particular to maintain the tank headspace below 60 percent of the lower flammability limit (lfl) for benzene generation rates of greater than 7 mg/(L.h)) from possible accelerated reaction of excess NaTPB. Current maximal operating temperatures of 40 C and the lack of protection against palladium entering Tank 48H provide insufficient protection against the onset of the reaction. Similarly, control of the amount of excess NaTPB, purification of the organic, or limiting the benzene content of the slurry (via stirring) and ionic strength of the waste mixture prove inadequate to assure safe operation.
NTIS
Sodium; Decomposition; Catalysts

19990026135 Department of Energy, Washington, DC USA
Tetraphenylborate Solubility in High Ionic Strength Salt Solutions
Serkiz, S. M., Department of Energy, USA; Ginn, J. D., Department of Energy, USA; Jurgensen, A. R., Department of Energy, USA; Apr. 30, 1998; 39p; In English
Report No.(s): DE98-053171; WSRC-TR-98-00103; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Solubility of sodium and potassium salts of the tetraphenylborate ion (TPB) in simulated Savannah River Site High Level Waste was investigated. Data generated from this study allow more accurate predictions of TPB solubility at the In-Tank Precipitation (ITP) facility. Because previous research showed large deviations in the observed solubility of TPB salts when compared with model predictions, additional data were generated to better understand the solubility of TPB in more complex systems of high

ionic strength and those containing both potassium and sodium. These data allow evaluation of the ability of current models to accurately predict equilibrium TPB concentrations over the range of experimental conditions investigated in this study.
NTIS
Solubility; High Strength; Sodium

19990026136 Department of Energy, Washington, DC USA
ITP Solids Stability Operating Window Tests
Walker, D. D., Department of Energy, USA; Apr. 30, 1998; 37p; In English
Report No.(s): DE98-053172; WSRC-TR-98-00072; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Tetraphenylborate (TPB) solids provide a potentially large source of benzene in the slurries produced in the In-Tank Precipitation (ITP) process. The stability of the solids is an important consideration in the safety analysis of the process. Recent tests investigated the stability of the potassium tetraphenylborate (KTPB) solids under process conditions, during both precipitation and washing. In addition, the tests measured the relative stabilities of the sodium, potassium and cesium tetraphenylborate (NaTPB, KTPB, and CsTPB, respectively). Additional tests examined the similarity of the catalytic system in the reaction of soluble and insoluble tetraphenylborates.
NTIS
Stability Tests; Precipitation (Chemistry); Tanks (Containers)

19990026144 Department of Energy, Office of Environmental Restoration and Waste Management, Washington, DC USA
Summary of Tests to Determine Effectiveness of Gelatin Strike on SS(ampersand)C Dissolver Solutions
Murray, A. M., Department of Energy, USA; Karraker, D. G., Department of Energy, USA; May 31, 1998; 13p; In English
Report No.(s): DE98-054751; WSRC-TR-98-00186; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The solutions from the dissolution of sand, slag, and crucible (SS&C) material are sufficiently different from previous solutions processed via the F-Canyon Purex process that the effectiveness of individual process steps needed to be ascertained. In this study, the effectiveness of gelatin strike was tested under a variety of conditions. Specifically, several concentrations of silica, fluoride, nitric acid HNO3, boric acid H3BO3, and aluminium nitrate nonahydrate (ANN) were studied. The disengagement times of surrogate and plant SS&C dissolver solutions from plant solvent also were measured. The results of the tests indicate that gelatin strike does not coagulate the silica at the low concentration of silica ((tilde 30) ppm) expected in the SS&C dissolver solutions because the silicon is complexed with fluoride ions (e.g., SiF6(exp -2)). The silicon fluoride complex is expected to remain with the aqueous phase during solvent extraction. The disengagement times of the dissolver solutions from the plant solvent were not affected by the presence of low concentrations of silica and no third phase formation was observed in the disengagement phase with the low silica concentrations. Tests of surrogate SS&C dissolver solutions with higher concentration of silica (less than 150 ppm) did show that gelatin strike followed by centrifugation resulted in good phase disengagement of the surrogate SS(ampersand)C dissolver solution from the plant dissolver solution. At the higher silica concentrations, there is not sufficient fluoride to complex with the silica, and the silica must be entrained by the gelatin and removed from the dissolver solution prior to solvent extraction.
NTIS
Gelatins; Dissolving

19990026243 Department of Energy, Office of Environmental Restoration and Waste Management, Washington, DC USA
Solubility of Phenylborate Compounds in Benzene
Eibling, R. E., Department of Energy, USA; Apr. 30, 1998; 9p; In English
Report No.(s): DE98-057627; WSRC-TR-98-00129; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The original goal of this scoping study was to determine if the solubility of sodium and potassium tetraphenylborates in benzene was sufficiently large to justify designing and performing kinetic studies on a benzene-phase catalytic reaction.
NTIS
Solubility; Benzene; Sodium; Potassium

19990026629 Department of the Navy, Washington, DC USA
2:2 Mixed Fluoro-, and Fluoronitroalkyl Orthocarbonates
Gilligan, William H., Inventor; Jul. 21, 1998; 5p; In English; Supersedes US-Patent-Appl-SN-253476
Patent Info.: Filed 30 Mar. 81,; US-Patent-Appl-SN-253,476; US-Patent-5,783,732
Report No.(s): AD-D019222; No Copyright; Avail: US Patent and Trademark Office, Microfiche

2:2 mixed orthocarbonates of the formula RCH2O2C + OCH2R'2 wherein R (not equal to) R' and wherein R and R' are -C(NO2)3, -CF(NO2)2, -CF2(NO2), -C(NO2)2CH3, -CH(NO2)CH3, -CH(NO2)CH3, -CH2(NO2). -CF3, or -CF2CF3 and methods of preparation. Additionally. orthoformates of the formula C + OCH3R4 wherein R is -C(NO2)2CH3, -CF2(NO2), -CH(NO2)CH3, and -CH2(NO2) and methods of preparation.

DTIC
Methyl Compounds; Synthesis (Chemistry); Iron Compounds; Alkyl Compounds; Carbonates

24
COMPOSITE MATERIALS

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

19990025292 Naval Surface Warfare Center, Carderock Div., Bethesda, MD USA
The Analysis and Design of Tee-Joints for Composite Hull Structures *Final Report*
Bish, jack; Kedward, Keith T.; Jun. 1997; 117p; In English
Contract(s)/Grant(s): N615330-95-C-0021
Report No.(s): AD-A358888; NSWCCD-65-TR-1998/11+CR; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The design of polymer matrix composite joints is strongly influenced by the presence of out-of-plane or through-the-thickness stresses. These stresses can be critical, since out-of-plane interlaminar tension and shear strengths, as well as moduli, are strongly influenced by the low strength and stiffness of the polymer matrix constituents, as well as the fiber matrix interface. to aid in the design of these structures, this research develops a methodology for predicting structural adequacy of composites in the presence of through-the-thickness loadings. Specifically, this work details guidelines for the design of resin fillet tee-joints for use in marine applications. A combination of finite element analyses and approximate analytical formulations are used to create these practically oriented design guidelines. A parametric study, using finite element models, was conducted examining the effects of changing various material and geometric variables on the stresses and failure modes of the tee-joint structure. The tee-joint structure was sectioned in order to facilitate the creation of analytical approximations to predict the failure stresses in the various sections. This approach offers the added benefit of developing insight that guides the designer towards the most appropriate joint configuration for a specific application.

DTIC
Polymer Matrix Composites; Composite Structures; Hulls (Structures); Marine Technology

19990025561 NASA Langley Research Center, Hampton,VA USA
Testing and Analysis of Composite Skin/Stringer Debonding Under Multi-Axial Loading
Krueger, Ronald, NASA Langley Research Center, USA; Cvitkovich, Michael K., NASA Langley Research Center, USA; OBrien, T. Kevin, Army Research Lab., USA; Minguet, Pierre J., Boeing Co., USA; Feb. 1999; 59p; In English
Contract(s)/Grant(s): RTOP 538-02-10-01
Report No.(s): NASA/TM-1999-209097; L-17810; NAS 1.15:209097; ARL-MR-439; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Damage mechanisms in composite bonded skin/stringer constructions under uniaxial and biaxial (in-plane/out- of-plane) loading conditions were examined. Specimens consisted of a tapered composite flange bonded onto a composite skin. Tests were performed under monotonic loading conditions in tension, three-point bending, and combined tension/bending . For combined tension/bending testing, a unique servohydraulic load frame was used that was capable of applying both in-plane tension and out-of-plane bending loads simultaneously. Specimen edges were examined on the microscope to document the damage occurrence and to identify typical damage patterns. The observations showed that, for all three load cases, failure initiated in the flange, near the flange tip, causing the flange to almost fully debond from the skin. A two-dimensional plane-strain finite element model was developed to analyze the different test cases using a geometrically nonlinear solution. For all three loading conditions, principal stresses exceeded the transverse strength of the material in the flange area. Additionally, delaminations of various lengths were

simulated in two locations where delaminations were observed. The analyses showed that unstable delamination propagation is likely to occur in one location at the loads corresponding to matrix ply crack initiation for all three load cases.
Author
Composite Materials; Stringers; Axial Loads; Skin (Structural Member); Damage; Tests; Debonding (Materials)

19990025573 NASA Goddard Space Flight Center, Greenbelt, MD USA
Ground-Based Testing of Replacement Thermal Control Materials for the Hubble Space Telescope
Townsend, Jacqueline A., NASA Goddard Space Flight Center, USA; Hansen, Patricia A., NASA Goddard Space Flight Center, USA; McClendon, Mark W., NASA Goddard Space Flight Center, USA; deGroh, Kim K., NASA Lewis Research Center, USA; Banks, Bruce A., NASA Lewis Research Center, USA; Triolo, Jack J., Swales Aerospace, USA; High Performance Polymers Journal; 1998; 28p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The mechanical and optical properties of the metallized Teflon FEP thermal control materials on the Hubble Space Telescope (HST) have degraded over the nearly seven years the telescope has been in orbit. Given the damage to the outer layer of the multi-layer insulation (MLI) that was apparent during the second servicing mission (SM2), the decision was made to replace the outer layer during subsequent servicing missions. A Failure Review Board was established to investigate the damage to the MLI and identify a replacement material. The replacement material had to meet the stringent thermal requirements of the spacecraft and maintain mechanical integrity for at least ten years. Ten candidate materials were selected and exposed to ten-year HST-equivalent doses of simulated orbital environments. Samples of the candidates were exposed sequentially to low and high energy electrons and protons, atomic oxygen, x-ray radiation, ultraviolet radiation and thermal cycling. Following the exposures, the mechanical integrity and optical properties of the candidates were investigated using Optical Microscopy, Scanning Electron Microscopy (SEM), a Laboratory Portable Spectroreflectometer (LPSR) and a Lambda 9 Spectroreflectometer. Based on the results of these simulations and analyses, the Failure Review Board selected a replacement material and two alternates that showed the highest likelihood of providing the requisite thermal properties and surviving for ten years in orbit.
Author
Hubble Space Telescope; Aerospace Environments; Multilayer Insulation; Reflectometers; Scanning Electron Microscopy; Teflon (Trademark); Temperature Control; Thermal Cycling Tests; Thermodynamic Properties

19990025574 Hebrew Univ., Jerusalem Israel
International Conference on Composite Interfaces
May 1996; 186p; In English; 6th, USA
Report No.(s): AD-A358805; EOARD-CSP-96-1001; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

The Final Proceedings for Sixth International Conference on Composite Interfaces, 5 May 1996 - 8 May 1996 Molecular interactions at interfaces, Structural Characterization, Theoretical aspects of the interfaces/interphases, interfacial adhesion: theory and applications, surface characterization techniques, surface treatments.
DTIC
Interfaces; Composite Materials; Conferences; Interfacial Energy; Surface Treatment

19990025642 Czech Technical Univ., Prague Czechoslovakia
Nondestructive Characterization of Materials
Jan. 1995; 125p; In English; 7th, USA
Contract(s)/Grant(s): F61708-95-W-0164
Report No.(s): AD-A359000; EOARD-CSP-95-1017; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The Final Proceedings for Seventh International Symposium on Non-Destructive Characterization of Materials, 19 June 1995 - 23 June 1995. The Topics covered include: the conference will focus on expanding the role of non-destructive evaluation of all types of materials. a unique focus will be the application of non-destructive techniques for the characterization of material properties such as elastic modulus.
DTIC
Nondestructive Tests; Modulus of Elasticity; Conferences; Composite Materials

19990025937 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA USA

The Third International Conference on Progress in Durability Analysis of Composite Systems ***Final Report, 14 Aug. 1997 - 28 Aug. 1998***

Reifsnider, Kenneth L.; Feb. 01, 1999; 345p; In English

Contract(s)/Grant(s): N00014-97-1-0760

Report No.(s): AD-A359548; 4-30710; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche

Composite materials are widely used in a variety of applied technologies including transportation, off-shore, power, electronics, communications, sports equipment, and infrastructure industries. In the last few years, these applications have matured in many ways. For example, polymer composites are increasingly used in primary and man-rated structures. A controlling feature of the general use of composite systems is their damage tolerance, durability, and reliability. That is the subject of the present book. The papers in this volume were generated as a result of the Third International Conference on Progress in Durability Analysis of Composite Systems, held on 14-17 September 1997 on the campus of Virginia Polytechnic Institute and State University in Blacksburg, Virginia. Delegates from 19 countries and more than a dozen universities and a like number of industries participated in the conference.

DTIC

Composite Materials; Mechanical Properties; Conferences; Durability

19990025947 Massachusetts Inst. of Tech., Dept. of Chemical Engineering, Cambridge, MA USA

Processing of Nanocrystalline Nitrides and Oxide Composites ***Progress Report, 1 Oct. 1998 - 31 Dec. 1998***

Ying, Jackie Y.; Dec. 31, 1998; 5p; In English

Contract(s)/Grant(s): N00014-95-1-0626

Report No.(s): AD-A358838; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We have recently begun to investigate the chemical composition, specifically oxygen contamination, and sintering behavior of the nanocrystalline aluminum nitride synthesized in the forced flow reactor. Our initial results from these studies show that nanocrystalline aluminum nitride can be produced with high purity (less than 4 wt% oxygen), and that full densification can be achieved without the use of sintering aids. In addition, hot pressed compacts of nanocrystalline aluminum nitride show an unusual degree of texturing after sintering, which may make these materials interesting for piezoelectric as well as thermal applications.

DTIC

Aluminum Nitrides; Chemical Composition; Compacting; Densification; Hot Pressing; Nitrides; Oxides

19990025964 Naval Academy, Div. of Engineering and Weapons, Annapolis, MD USA

Experimental Modal Analysis of a Sandwich Construction, Glass Reinforced Plastic Composite Deck Panel

Ratcliffe, Colin P.; Jul. 1996; 72p; In English

Report No.(s): AD-A359147; USNA-EW-10-96; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report details the experimental modal analysis of a 20-ft by 6-ft sandwich construction glass reinforced plastic panel. The panel includes four compliant foundations, which are designed to be equipment supports. The analysis reveals that below the fundamental resonance of the foundations, the structure behaves in a similar fashion to a uniform plate. The foundations do not show appreciable vibration. Above the fundamental of the straps, there is significant sympathetic vibration between the deck and foundations.

DTIC

Composite Structures; Elastic Properties; Glass Fiber Reinforced Plastics; Sandwich Structures

19990025987 Lockheed Martin Corp., Palmdale, CA USA

Just the Right Amount of Reinforcement

Walton, Greg, Lockheed Martin Corp., USA; High Performance Composites Magazine; 1998; 6p; In English

Contract(s)/Grant(s): NCC8-115; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Lockheed Martin Skunk Works, is taking the next step towards economical low-Earth-orbit (LEO) operations with NASA's X-33 technology demonstrator, that uses composite tanks for liquid hydrogen (LH sub2) fuel storage and structural support, The X-33 is a 53% scale model of the VentureStar single-stage-to-orbit (SSTO) reusable launch vehicle(RLV) projected to orbit payloads at a rate, of $1,000 per pound beginning in 2004 In order to make VentureStar completely reusable and economical engineers are using composite materials throughout the spacecrafts structure. The first test of the design comes in 1999 on the X-33 technology demonstrator. Two of the primary structures that engineers will be evaluating are the carbon fiber/epoxy LH2 fuel tanks. The 29-ft long by 18-ft wide tanks, which fill two-thirds of the X-33's interior, serve a dual purpose carrying fuel and providing structural support to the walls of the spacecraft. Fiber placement makes it possible to build the fuel tanks, large, light and strong enough

to satisfy X33's requirements. Lockheed Martin choose the fabrication technology to produce the eight sections of each tank because of fiber placement's ability to handle complex surfaces, speed and repeatability.
Derived from text
Carbon Fibers; Epoxy Matrix Composites; Fabrication; Fiber Composites; Liquid Hydrogen; Single Stage to Orbit Vehicles; X-33 Reusable Launch Vehicle; Propellant Tanks

19990026057 Department of Energy, Assistant Secretary for Fossil Energy, Washington, DC USA
Morgantown Energy Technology Center for the interfacial coatings for ceramic-matrix composites
Jan. 09, 1997; 24p; In English
Report No.(s): DE97-002188; DOE/MC/32085-5522; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This report summarizes the task conducted to examine various activities on interface development for ceramic-matrix composites (CMCs) intended for high-temperature applications. While several articles have been published on the subject of CMC interfaces, the purpose of this report is to describe the various ongoing efforts on interface concepts, material selection, and issues related to processing methods employed for developing interface coatings. The most exciting and new development in the field is the discovery of monazite as a potential interface material for mullite- and alumina-based composites. Monazite offers two critical properties to the CMC system; a weakly bonded layer due to its non-wetting behavior and chemical compatibility with both alumina and mullite up to very high temperatures (> 1,600 C). A description of the Department of Energy-related activities and some thoughts on processing issues, interface testing, and effects of processing on fiber strength are given.
NTIS
Interfaces; Protective Coatings; Coating; Ceramic Matrix Composites

19990026124 Department of Energy, Office of Energy Research, Washington, DC USA
Formation of Nanometallic Clusters in Silica by Ion Implantation
Ila, D., Department of Energy, USA; Oct. 31, 1997; 16p; In English; 9th; Radiation Effects in Insulators, Unknown
Report No.(s): DE98-000687; ORNL/CP-94848; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

We have changed both linear and nonlinear optical properties of suprasil-1 by implanting 2.0 MeV copper, 350 keV tin, 1.5 MeV silver and 3.0 MeV gold.These changes were induced both by over implantation above the threshold fluence for spontaneous cluster formation and by subsequent thermal annealing, and are due to an increase in resonance optical absorption as well as an enhancement of the nonlinear optical properties. Using optical absorption spectrophotometry and Rutherford Backscattering spectrometry, we have measured the cluster size for each heat treatment temperature. Using Z-scan technique we have determined the third order electric susceptibility for each implanted species to be 1.5 x 10(exp -6) esu for Sn nanoclusters, 2.7 x 10(exp -6) esu for Cu nanoclusters, 5 x 10(exp -7) esu for Ag nanoclusters, to 6.5 x 10(exp-7) esu for Au nanoclusters in suprasil- 1.
NTIS
Ion Implantation; Gold; Tin; Copper; Silver; Optical Properties; Silicon Dioxide

19990026125 Department of Energy, Office of Energy Research, Washington, DC USA
Fabrication of copper and gold nanoclusters in MgO(100) by MeV ion implantation
Zimmerman, R. L., Department of Energy, USA; Ila, D., Department of Energy, USA; Williams, E. K., Department of Energy, USA; Sarkisov, S. S., Department of Energy, USA; Poker, D. B., Department of Energy, USA; Oct. 31, 1997; 14p; In English; 9th; Radiation Effects in Insulators, Unknown
Report No.(s): DE98-000691; ORNL/CP-94847; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

MeV ions of Au and Cu were implanted into single crystals of MgO (100) and the formation of metallic nanoclusters was observed by an indirect method of optical absorption spectrophotometry. Using Mei's theory the authors related the observed optical absorption band to the formation of nanoclusters and using Doyle's theory, as well as Rutherford Backscattering Spectrometry (RB S), the authors correlated the fill width half maximum (FWHM) of the absorption bands to the estimated size of the metallic nanoclusters between 1--10 nm. These clusters were formed by implantation above the threshold fluence for cluster formation and by a combination of threshold fluence of the implanted species and thermal annealing. The changes in the estimated size of the nanoclusters, after annealing at temperatures ranging from 5,000 C to 10,000 C, were observed using optical absorption spectrophotometry and calculated using Doyle's theory.
NTIS
Gold; Copper; Ion Implantation; Magnesium Oxides; Fabrication; Single Crystals

19990026147 Department of Energy, Office of Energy Research, Washington, DC USA

Application of cathodic arc deposited amorphous hard carbon films to the head/disk tribology

Anders, S., Department of Energy, USA; Bhatia, C. S., Department of Energy, USA; Fong, W., Department of Energy, USA; Lo, R. Y., Department of Energy, USA; Bogy, D. B., Department of Energy, USA; Apr. 30, 1998; 14p; In English, USA; Sponsored by Materials Research Society, USA

Report No.(s): DE98-057484; LBNL-41063; CONF-980405; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Amorphous hard carbon films deposited by filtered cathodic arc deposition exhibit very high hardness and elastic modulus, high mass density, low coefficient of friction, and the films are very smooth. All these properties are beneficial to applications of these films for the head/disk interface tribology. The properties of cathodic arc deposited amorphous carbon films are summarized, and they are compared to sputter deposited, hydrogenated CH(sub x) , and nitrogenated CN(sub x) carbon films which are the present choice for hard disk and slider coatings. New developments in cathodic arc coaters are discussed which are of interest to the disk drive industry. Experiments on the nanotribology, mass density and hardness, corrosion behavior, and tribochemical behavior of cathodic arc films are reported. A number of applications of cathodic arc deposited films to hard disk and slider coatings are described. It is shown that their tribological performance is considerably better compared to CH(sub x) and CN(sub x) films.

NTIS

Amorphous Materials; Carbon; Thin Films; Tribology; Deposition; Magnetic Disks

19990026150 Department of Energy, Office of Energy Research, Washington, DC USA

X-ray microscopy: An emerging technique for semiconductor microstructure characterization

Padmore, H. A., Department of Energy, USA; May 31, 1998; 7p; In English; Characterization and metrology for ULSI technology

Report No.(s): DE98-057494; LBNL-41908; LSBL-465; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The advent of third generation synchrotron radiation x-ray sources, such as the Advanced Light Source (ALS) at Berkeley have enabled the practical realization of a wide range of new techniques in which mature chemical or structural probes such as x-ray photoelectron spectroscopy (XPS) and x-ray diffraction are used in conjunction with microfocused x-ray beams. In this paper the characteristics of some of these new microscopes are described, particularly in reference to their applicability to the characterization of semiconductor microstructures.

NTIS

Microscopy; X Rays; Semiconductors (Materials); Microstructure; Microscopes

19990026282 Department of Energy, Office of Environmental Restoration and Waste Management, Washington, DC USA

Fabrication and testing of engineered forms of Self-Assembled Monolayers on Mesoporous Silica (SAMMS) material

Mattigod, S. V., Department of Energy, USA; Liu, J., Department of Energy, USA; Fryxell, G. E., Department of Energy, USA; Baskaran, S., Department of Energy, USA; Gong, M., Department of Energy, USA; Sep. 30, 1998; 27p; In English

Report No.(s): DE98-059366; PNNL-12007; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A number of engineered forms such as flexible extrudates, beads, and rods were fabricated using thiol-SAMMS (Self-Assembled Monolayers on Mesoporous Silica) and tested for their mercury adsorption capacities. The flexible extrudate form had a mercury adsorption capacity of 340 mg/g but was found to be structurally unstable. A structurally sound bead form of thiol-SAMMS was fabricated with 5, 10, 25, and 40% by weight clay binder (attapulgite) and successfully functionalized. A structurally stable but non-optimized rod form of thiol-SAMMS was also fabricated. Bench-scale processes were developed to silanize and functionalize mesoporous silica beads made with attapulgite clay binder. Contact angle measurements were conducted to assess the degree of surface coverage by functional groups on mesoporous silica materials.

NTIS

Porous Materials; Silicon Dioxide; Adsorption; Fabrication

19990026383 Department of Energy, Washington, DC USA

Chemical bonding in hard boron-nitride multilayers

Jankowski, A. F., Department of Energy, USA; Hayes, J. P., Department of Energy, USA; Jun. 01, 1997; 16p; In English

Report No.(s): DE98-050876; UCRL-JC-127545; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The oxides and nitrides of boron show great potential for use as hard, wear resistant materials. However, large intrinsic stresses and poor adhesion often accompany the hard coatings as found for the cubic boron-nitride phase. These effects may be moderated for use of a layered structure. Alternate stiff layers of boron and compliant layers of nitride are formed by modulating

the sputter gas composition during deposition of boron target. The B/BN thin films are characterized with transmission electronic microscope to evaluate the microstructure, nanoindentation to measure hardness and ex-ray absorption spectroscopy to determine chemical bonding. The effects of layer pair spacing on chemical bonding and hardness are evaluated for the B/BN films.
NTIS
Chemical Bonds; Boron Oxides; Boron Nitrides; Conferences; Wear Resistance; Thin Films; Nitrides; Elastic Properties

19990026399 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Thermal conductivity and other properties of cementitious grouts
Allan, M., Department of Energy, USA; Dec. 31, 1998; 15p; In English
Report No.(s): DE98-006069; BNL-65640; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The thermal conductivity and other properties cementitious grouts have been investigated in order to determine suitability of these materials for grouting vertical boreholes used with geothermal heat pumps. The roles of mix variables such as water/cement ratio, sand/cement ratio and superplasticizer dosage were measured. In addition to thermal conductivity, the cementitious grouts were also tested for bleeding, permeability, bond to HDPE pipe, shrinkage, coefficient of thermal expansion, exotherm, durability and environmental impact. This paper summarizes the results for selected grout mixes. Relatively high thermal conductivities were obtained and this leads to reduction in predicted bore length and installation costs. Improvements in shrinkage resistance and bonding were achieved.
NTIS
Heat Pumps; Heating; Thermal Conductivity; Cements; Grout; Geothermal Resources; Seals (Stoppers)

19990026667 Department of Energy, Washington, DC USA
Sound speed and thermal property measurements of inert materials: laser spectroscopy and the diamond-anvil cell
Zaug, J. M., Department of Energy, USA; Jul. 01, 1997; 9p; In English; Shock Compression of Condensed Matter of the American Physical Society, USA
Report No.(s): DE98-051118; UCRL-JC-127998; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

An indispensable companion to dynamical physics experimentation, static high-pressure diamond-anvil cell research continues to evolve, with laser diagnostic, as an accurate and versatile experimental deep planetary properties have bootstrapped each other in a process that has produced even higher pressures; consistently improved calibrations of temperature and pressure under static and dynamic conditions; and unprecedented data and understanding of materials, their elasticity, equations of state (EOS), and transport properties under extreme conditions. A collection of recent pressure and/or temperature dependent acoustic and thermal measurements and deduced mechanical properties and EOS data are summarized for a wide range of materials including H2, H2O, H2S, D2S, CO2, CH4, N2O, CH3OH,, SiO2, synthetic lubricants, PMMA, single crystal silicates, and ceramic superconductors. Room Pump;T sound speed measurements are presented for the first time on single crystals of beta-HMX. New high-pressure and temperature diamond cell designed and pressure calibrant materials are reviewed.
NTIS
Laser Spectroscopy; Thermodynamic Properties; Electromagnetic Noise Measurement; Experimentation; Acoustic Velocity

19990026682 Department of Energy, Office of Energy Research, Washington, DC USA
New approach to the fabrication of 'smart' near-surface nanostructure composites
Gea, L., Department of Energy, USA; Honda, S., Department of Energy, USA; Boatner, L. A., Department of Energy, USA; Haynes, T. E., Department of Energy, USA; Sales, B. C., Department of Energy, USA; Jan. 31, 1998; 9p; In English; Sponsored by Materials Research Society, USA
Report No.(s): DE97-009372; ORNL/CP-96051; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A new method for the formation of smart near-surface nanoscale composites has been developed. In this approach, small precipitates of active phases are embedded in the near-surface region of the material that is to be modified by a combination of ion implantation and thermal processing. The dispersion, concentration, and microstructure of the nanocrystals formed in the substrate material can be tailored through a careful choice of processing parameters - making this approach well suited to high value added, high technology applications. The applicability of this approach to forming smart surfaces on otherwise inactive materials was established in the case of VO(exp 2) precipitates which were embedded in Al2O3 single crystals to create a medium suitable for optical applications--including optical data storage. Most recently, this concept has been extended to the fabrication of magnetic field sensitive nanostructured surfaces by forming magnetostrictive precipitates of materials such as Ni or RFe2 (with R =

Tm, Tb, Sm) that are embedded in various single crystal oxide hosts. These nanostructured, active surface composites have been characterized using XRD, RBS, TEM, and magneto-optical techniques.
NTIS
Fabrication; Nanostructure (Characteristics); Composite Materials

25
INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry. For related information see also 77 Thermodynamics and Statistical Physics.

19990025194 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China
Mass Transfer of Phenol Extraction Between Two Phases in a Constant Interfacial Area Cell and Stirring Tank
Wang, Maw-Ling, National Tsing Hua Univ., Taiwan, Province of China; Liu, Biing-Lang, Yuan-Ze Inst. of Tech., Taiwan, Province of China; Journal of the Chinese Institute of Engineers: Transactions of the Chinese Institute of Engineers, Series A; January 1998; ISSN 0253-3839; Volume 21, No. 1, pp. 1-9; In English
Contract(s)/Grant(s): ERC-001-1988; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

In this work, a simple model is provided which accounts for any value of distribution coefficient of a solute, to describe the mass transfer for a batch process of extracting the solute between two immiscible fluids. A Lewis cell of constant interfacial area and a stirring tank were employed as the apparatuses for measuring the mass transfer rates of the solute between two immiscible phases. The model, which was based on the two-film theory to determine the rate of mass transfer of solute across the interface, and the equilibrium concentration of solute at the interface, was derived and used to express the extraction of phenol. Experimental work, in which phenol was extracted from the aqueous phase to the organic phase by trioctylamine sulfate salts (TOA salts) dissolved in trioctylamine (TOA), was conducted to obtain the mass transfer coefficient. The effects of the operating conditions in a constant interfacial area cell and in the stirring tank are both discussed.
Author
Mass Transfer; Phenols; Liquid-Liquid Interfaces; Solutes; Extraction; Stirring

19990025276 Princeton Univ., Dept. of Material and Aerospace Engineering, NJ USA
AASERT95/Science and Engineering Training in Combustion and Propulsion ***Final Report, 1 Sep. 1995 - 31 Aug. 1998***
Glassman, I.; Jan. 11, 1999; 13p; In English
Contract(s)/Grant(s): F49620-95-1-0406; AF Proj. 3484
Report No.(s): AD-A359227; AFRL-SR-BL-TR-99-0009; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

AASERT support permitted an additional graduate student to be added to AFOSR's "Fuels Combustion Research" program at Princeton. This support allowed fuel pyrolysis and combustion to be studied under both sub and supercritical conditions. This newly integrated program, with AASERT support, proved to be an enormous success. It was found that under supercritical conditions the pyrolysis rate of fuels have a pre-exponential rate A factor order of magnitudes greater than results obtained at 1 atm. The activation energies of the complete energy range tested remained the same. Further, due to the phenomenon known as "caging" for the fuels studied, cyclic hydrocarbons formed under supercritical conditions, but not at 1 atm, and these cyclic hydrocarbons led to polynuclear aromatics (PAH) that are the precursors to particulate formation.
DTIC
Combustion; Jet Engine Fuels; Activation Energy; Polycyclic Aromatic Hydrocarbons; Education; Fuel Combustion

19990025277 Rockwell International Corp., Science Center, Thousand Oaks, CA USA
Advanced Synthesis of Carbon Nitride ***Final Report, 6 Jan. 1997 - 30 Nov. 1998***
Benard, D. J.; Dec. 01, 1998; 40p; In English
Contract(s)/Grant(s): F49620-97-C0023; AF Proj. 2303
Report No.(s): AD-A359222; SC71133.FTR; AFRL-SR-BL-TR-99-0012; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Thin films composed of carbon and nitrogen were generated on a variety of substrates by deposition of radicals obtained after dissociation of gaseous cyanogen azide or solid cyanuric triazide (CTA). These intermediates were obtained upon reacting cyanogen halides or cyanuric chloride, respectively, with sodium azide. The CTA was chemically pure, whereas the gaseous azides were contaminated by halogens that were difficult to safely remove. Energy transfer from discharged nitrogen in a low-pressure flow-tube reactor was used to dissociate cyanogen azide and ultraviolet photolysis was employed at ambient pressure to dissociate CTA.

Films generated at low pressure demonstrated a bandgap of 2.6 eV with a 2.3 refractive index at visible wavelength. X-ray photoelectron spectroscopy showed the films to consist of near equal yields of diamond-like carbon and a phase with carbon nitride stoichiometry. Films from both donors demonstrated absorption bands in the infrared that peaked at 1600 and 3150 wave numbers. Film adhesion was best on silicon carbide and aluminum nitride, on substrates that were heated during deposition, and when made from CTA. Deposition onto silicon carbide or aluminum nitride at 360 deg C yielded crystalline films with x-ray diffraction peaks that precisely matched the known ultrahard beta-phase of carbon nitride.
DTIC
Synthesis; Nitrides; Thin Films; Carbon; Photoelectron Spectroscopy

19990025278 Massachusetts Univ., North Dartmouth, MA USA
Electrode Surface Modification for Cathode Catalysis in Semi-Fuel Cells ***Final Report, 1 Jan. - 30 Sep. 1998***
Bessette, Russell R.; Dec. 16, 1998; 8p; In English
Contract(s)/Grant(s): N00014-98-1-0278
Report No.(s): AD-A359211; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The characterization and use of a palladium and iridium catalyst combination in an aluminum-hydrogen peroxide semi-fuel cell is described. The Pd/Ir combination outperforms palladium alone or iridium alone on the same substrate. Scanning Electron Microscopy (SEM) data of Pd and Ir catalyzed nickel and planar carbon substrates show non-uniform coverage of the nickel substrate but uniform coverage of the carbon substrate. X-ray Photoelectron Spectroscopy (XPS) spectra of Pd alone, Ir alone and the Pd/Ir combination on nickel foil and carbon substrates are inconclusive. The presence of adventitious carbon and perhaps oxygen make interpretation of the spectra inconclusive at this time. Anodic and cathodic efficiency studies using silver foil and Pd/Ir on carbon as catalysts and EB50V aluminum alloy as the anode are reported upon. Operation of the Al-H2O2 semi-fuel cell incorporating a Pd/Ir on carbon cathode at low current densities yielded H2O2 reduction efficiencies in the 60 to 70% range.
DTIC
Cathodes; Catalysis; Fuel Cells; Aluminum Alloys; Current Density; Electrodes

19990025282 Colorado State Univ., Fort Collins, CO USA
Conference on Current Issues of Chemical Mixtures ***Final Report, 1 Jul. 1997 - 30 Sep. 1998***
Yang, Raymond S.; Nov. 1998; 5p; In English
Contract(s)/Grant(s): DAMD17-97-1-7332
Report No.(s): AD-A359198; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Between 11 and 13 August 1997, a conference on Current Issues of Chemical Mixtures was held and hosted at Fort Collins, Colorado, by the Colorado State University (CSU) and the National Institute of Environmental Health Sciences (NIEHS) Superfund Basic Research Program (SBRP). Other sponsors of the conference included the Agency for Toxic Substances and Disease Registry (ATSDR), the U.S. Environmental Protection Agency (both the Office of Solid Waste and Emergency Response and the Region VIII Office), the U.S. Army Center for Environmental Health Research, and the Electric Power Research Institute (EPRI). Over 160 participants, coming from Canada, France, Germany, Japan, Mexico, the Netherlands, Norway, Sweden, and the U.S., are scientists, engineers, policy makers, and individuals with a profound interest in the issues related to hazardous waste disposal and contamination. The Conference consisted of six sessions: (1) Overview of Human Health and Regulatory Problems Related to Chemical Mixture Exposures; (2) Biomedical Advances on Chemical Mixtures I; (3) Biomedical Advances on Chemical Mixtures II; (4) Methodological Advances on the Toxicology of Chemical Mixtures; (5) Ecological and Engineering Advances on Chemical Mixture Research; and (6) Risk Assessment Issues Related to Hazardous Waste Chemical Mixtures.
DTIC
Environment Protection; Toxic Diseases; Waste Disposal; Hazardous Wastes; Contamination; Health; Solid Wastes

19990025284 Army Construction Engineering Research Lab., Champaign, IL USA
Alkaline Hydrolysis/Biodegradation of Nitrocellulose Fines ***Final Report***
Kim, Byung J.; Alleman, James E.; Quivey, David M.; Aug. 1998; 133p; In English
Report No.(s): AD-A359192; CERL-TR-98/65; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Cellulose nitrate constitutes an important industrial feedstock, with applications ranging from fingernail polish and photographic films, to explosives. The high level of nitration required for these explosive materials creates a significant environmental problem with respect to the necessary degradation of waste ”fines” inevitably discharged from their manufacturing operations. These waste solids have proven to be remarkably stable, leading to a traditional reliance on open-field incineration as a means of disposal. This research explored an alternative degradation procedure to eliminate the waste fines based on alkaline hydrolysis followed by biodegradation. In particular, the effort focused on optimizing the hydrolysis operation in terms of solids reduction,

practicality, and cost. In addition, biodegradation studies were conducted on the resulting hydrolysate to determine under what conditions amenability to biodegradation was maximized. Primarily using sodium hydroxide at low concentrations and temperatures, this research effort successfully achieved complete solubilization and denitration of the nitrocellulose. The resulting hydrolysate, containing significant concentrations of nitrite and nitrate, proved to be substantially amenable to aerobic biodegradation by an acclimated, mixed bacterial culture.
DTIC
Biodegradation; Cellulose Nitrate; Hydrolysis; Nitration; Fines

19990025285 Russian Academy of Natural Sciences, Inst. of Chemical Physicss, Moscow, Russia
Study of Combustion Mechanism of Nitramine-Polymer Mixtures ***Final Report, 15 Sep. 1997 - 15 Nov. 1998***
Zenin, Anatoli A., Russian Academy of Natural Sciences, Russia; Nov. 1998; 17p; In English
Contract(s)/Grant(s): N68171-97-M-5771
Report No.(s): AD-A359156; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Combustion mechanism of mixtures of RDX- and HMX-copolymer (like HTPB) was investigated by microthermocouple techniques. The following parameters were found and analysed at different pressures, sample initial temperatures and oxidizer content: burning rates, burning surface temperatures, temperatures and sizes of different zones of combustion waves, thickness of heat and melted layers in solid, characteristic thickness and conductive sizes in the gas phase, heat release in solid, heat feedback from gas to solid, heat release rate in gas, macrokinetic laws of solid gasification, temperature sensitivities of burning rate and burning surface temperature. It was established that the significant heat release in solid and the weak heat feedback from gas to solid are observed for all mixtures. The control region in the combustion waves which governs the burning rate is placed in solid and in a thin gas layer close to surface. It was found that increase of the amount of oxidizer in the mixtures decreases temperature sensitivities of burning rate and burning surface temperature for both oxidizers.
DTIC
Copolymers; Mixtures; Propellants; Combustion; RDX; Thermocouples; HMX; Nitramine Propellants

19990025479 Naval Academy, Annapolis, MD USA
Developing Methods in Capillary Electrophoresis for the Detection of Carbon Monoxide Poisoning
Durkin, David P.; Jan. 1998; 37p; In English
Report No.(s): AD-A359144; USNA-255; USNA-1531-2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This project demonstrates the use of capillary electrophoresis as an improvement to existing methods of analysis for carbon monoxide (CO) in human hemoglobin (Hb). Current methods for CO analysis are CO-oximetry and tonometry/gas chromatography, which involve lengthy sample manipulation followed by spectroscopic or gas displacement measurements. These methods are time-consuming and technically difficult because of the many manipulations they require. Capillary electrophoresis (CE), a modern analytical technique, is presented as a faster and easier method to quantify CO in Hb. Several steps towards the development of a CE procedure to detect CO in blood have been completed. The first step of this analysis involved isolating heme, the CO binding site in Hb, from the Hb molecule. Initially, mixtures of reduced heme and heme-CO were successfully isolated from Hb standards and separated using CE. Finally, reduced heme and heme-CO were isolated from three blood samples of CO-related accident victims and analyzed using CE. Differences in the heme-CO signals from blood samples known to contain fatal and non-fatal levels of CO were observed. These differences were quantified by measuring the areas under the peaks representative of reduced heme and heme-CO. Results indicate that an improvement was made to the current methods of CO analysis.
DTIC
Electrophoresis; Carbon Monoxide Poisoning; Intraocular Pressure; Hemoglobin; Carbon Monoxide

19990025487 Leeds Univ., UK
Spontaneous Ignition of Hydrocarbon Fuels at Temperatures in the Range 750 - 1500 K ***Final Report***
Griffiths, John Frederick, Leeds Univ., UK; Jan. 1998; 63p; In English
Contract(s)/Grant(s): F61775-98-WE103
Report No.(s): AD-A358872; EOARD-SPC-98-4072; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report results from a contract tasking The University of Leeds as follows: The contractor will investigate methods for enhancing the initiation of combustion in hydrocarbon fuels as outlined in his proposal submitted in April 1998.
DTIC
Ignition; Hydrocarbon Fuels; Fuel Combustion; Spontaneous Combustion

19990025568 Oklahoma State Univ., Dept. of Chemistry, Stillwater, OK USA

Chemical Dynamics Studies of Reactions in Solids ***Final Report, 1 Apr. 1995 - 30 Sep. 1998***

Thompson, Donald L., Oklahoma State Univ., USA; Sep. 1998; 12p; In English

Contract(s)/Grant(s): F49620-95-1-0310; AF Proj. 2303

Report No.(s): AD-A359255; AFRL-SR-BL-TR-99-0011; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Theoretical methods and atomic-level models were developed for studies of fundamental processes and properties of potential High Energy Density Materials (HEDM). The long-term goal of this research is to perform molecular dynamics and Monte Carlo simulations of the various kinds of processes, including chemical reactions, for systems that display the properties inherent in high-energy high-density materials. This research lays the groundwork for that by providing the theoretical and computational methods as well as accurate molecular and crystal models for important types of energetic systems; for example, molecules such as NTO (5-Nitro-2,4-dihydro-3H-1,2,4-triazol-3-one) and ADN (ammonium dinitramide). Classical dynamics simulations of molecular isomerization in a solid (Ar matrix) were performed for a prototypical energy material (HONO). A significant part of this project was the refinement of chemical dynamics methods for multidimensional problems. A new method was introduced in this work that can be used for accurate treatment of quantum effects such as tunneling in many-atom systems. A fundamental analysis of the failure in some cases of classical mechanics to accurately account for the behavior of zero-point energy was also presented. A method based on simple transtion-state theory was developed for computing the rates of mass migration in solids; it was demonstrated for various kinds of atoms in rare gas matrices, and the results are in good agreement with experiment.
DTIC

Solids; Molecular Dynamics; Classical Mechanics; Monte Carlo Method; Computerized Simulation; Chemical Reactions

19990025644 Texas Univ., San Antonio, TX USA

The Effect of Titanium Surface Roughness on MG63 Oseteblast-Like Cell Differentiation and Response to 1,25-Dihydroxyvitamin D3

Batzer, Richard C., Texas Univ., USA; Jan. 07, 1999; 83p; In English

Report No.(s): AD-A359039; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Surface roughness has been shown to affect cell differentiation and local factor production of MG63 osteoblast-like cells. The first specific aim of this study was to examine whether surface roughness alters the response of MG63 cells to circulating systemic hormones like 1,25-(OH)2D3 (1,25). Unalloyed titanium (Ti) disks were pretreated with HF/HNO3 (PT) and then machined and acid-etched (MA). Ti disks were also sandblasted (SB), sandblasted and acid-etched (CA), or plasma-sprayed with Ti particles (PS). The surfaces, from smoothest to roughest, were: PT, MA, CA, SB, and PS. MG63 cells were cultured to confluence on standard tissue culture polystyrene (plastic) or the Ti surfaces and then treated for 24 hours with either 10(exp -8)M or 10(exp -7)M 1,25-(OH)2D3 or vehicle (control). Cellular response was measured by assaying cell number, cell layer alkaline phosphatase specific activity, and the production of osteocalcin, latent transforming growth factor-beta (LTGFbeta), and prostaglandin E2 (PGE2). Alkaline phosphatase specific activity was affected by surface roughness; as the surface became rougher, the cultures showed a significant increase in alkaline phosphatase specific activity. Addition of 1,25-(OH)2D3 to the cultures caused a dose-dependent stimulation of alkaline phosphatase specific activity which was synergistic with the effect caused by surface roughness alone. 1,25-(OH)2D3 also caused a synergistic increase in osteocalcin production, as well as local factor (LTGFbeta and PGE2) production, on the rougher CA, SB and PS surfaces, but had no effect on the cultures grown on the smoother surfaces. The inhibitory effect of surface roughness on cell number was not affected by 1,25-(OH)2D3, except on the SB surface.
DTIC

Surface Roughness; Titanium; Bones; Surface Roughness Effects; Biomedical Data; Phosphates; Calciferol; Prostaglandins

19990025743 Aerosol Technology Ltd., Moscow, Russia

International Aerosol Symposium IAS-4

Belov, Nick N., Aerosol Technology Ltd., Russia; Jul. 1998; 942p; In English; 4th, 6-9 Jul. 1998, Sankt-Petersburg, Russia

Contract(s)/Grant(s): N68171-98-M-5377

Report No.(s): AD-A359242; ARDSG-R/D-8460-EN-02; No Copyright; Avail: CASI; A99, Hardcopy; A10, Microfiche

This report describes the meeting devoted to the Aerosol Science and Technology International Aerosol Symposium. The Symposium gathered aerosol scientists and technologists, engineers and administrators in most actual direction for environmental science and technology. Symposium activity included interaction of the Aerosol and Climate, Urban Aerosols, Filtration, Aerosol and Health, Space Debris, Bacteria in Air, Aerosol Measurements, Radiological Aerosols, Ecological Problems of Aerosols, Ultradispersed Powders, Membranes etc.
DTIC

Aerosols; Bacteria; Technologies; Research and Development; Filtration; Radiology

19990025772 Naval Postgraduate School, Monterey, CA USA
Soot Particles Size and Concentration Determination from a Kerosene/Gaseous Oxygen Rocket Plume
Silva, Silvino L.; Dec. 1998; 104p; In English
Report No.(s): AD-A358997; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

An experimental investigation was conducted to measure soot properties and concentration, and infrared signature of the plume of a kerosene/gaseous oxygen rocket motor. Multiple-wavelength measurements were used to obtain soot parameters. It was found that the multiple-wavelength technique appeared to work well for obtaining soot properties and concentration. The results implied that the soot particulate was very porous for the most fuel-rich conditions and became more compact as the 0/F ratio increased.
DTIC
Infrared Signatures; Plumes; Porosity; Rocket Engines

19990025773 California Univ., Dept. of Applied Sciences, Davis, CA USA
Plasma Deposition of Oxide-Coated Cathodes
Umstattd, Ryan J.; Sep. 1998; 101p; In English
Report No.(s): AD-A359078; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Vacuum arc deposition is employed to create a barium and/or strontium plasma which is subsequently deposited/implanted onto a nickel cathode substrate. The primary motivation for this work is the critical need for a reliable, repeatable, long-lived thermionic cathode for the production of high power, microsecond duration microwave pulses; such cathodes may also have applicability for lower current density continuous wave devices. This novel approach to manufacturing an oxide cathode eliminates the binders that may subsequently (and unpredictably) poison cathode emission. Removal of the poisoning mechanisms has yielded oxide cathodes capable of emission densities in the 20 A/sq cm regime. Cathode lifetime and emission may be varied via the control over the deposition parameters such as coating thickness, implantation energy, and plasma stoichiometry. The deposition is performed by generating a cathodic arc discharge at the surface of a barium or barium-strontium alloy rod. The metal plasma thus created is then deposited on the substrate which can be negatively biased to encourage implantation during the deposition process. The deposition is performed with sufficient background oxygen present to oxidize the highly reactive metal coating. The plasma deposition is monitored via a rate thickness monitor, an optical emission spectrometer for plasma composition information, and an electrostatic Langmuir probe for the determination of the plasma density and temperature profile. Cathodes thus produced are analyzed by drawing pulsed current at a constant voltage for various values of decreasing cathode temperature in order to generate practical work function distributions which provide an indication of the quality and expected life time of the cathode.
DTIC
Arc Discharges; Barium; Barium Alloys; Bias; Binders (Materials); Cathode Glow; Cathodes

19990025779 Washington Univ., Dept. of Medicinal Chemistry, Seattle, WA USA
Simulation of Protein Structure, Dynamics and Function in Organic Media ***Final Report, 1 May 1995 - 30 Jul. 1998***
Daggett, Valerie; Jul. 1998; 4p; In English
Report No.(s): AD-A359100; 97555; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The overall goal of our ONR-sponsored research is to pursue realistic molecular modeling strudies pertinnent to the related properties of protein stability, dynamics, structure, function, and folding in aqueous solution. We have developed mixed solvent systems to investigate the conformational behavior of peptides and proteins in response to a change in environment. We have also been studying hydrophobic hydration and how it may affect the diffusivity of molecules and how it may be harnassed in the design of biomaterials.
DTIC
Aqueous Solutions; Diffusivity; Folding; Hydration

19990025884 Envirogen, Inc., Lawrenceville, NJ USA
Utilization of Stable Carbon Isotope in the Verification of Bioremediation of Chlorinated Hydrocarbons ***Final Report, Jul. - Dec. 1995***
DeFlaun, M. F.; Steffan, R. J.; Van de Velde, K.; Oct. 1996; 55p; In English
Contract(s)/Grant(s): F08637-95-C-6024
Report No.(s): AD-A359310; AL/EQ-TR-1996-0025; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The overall goal of this work was to test the feasibility of using stable carbon isotope analysis to verify in situ biodegradation of hydrocarbons and chlorinated ethenes under aerobic conditions. Specific objectives were to 1) determine d13C values for TCE and the various compounds to be used as co-substrates for TCE degradation; 2) evaluate effects of aerobic biodegradation of co-

substrate compounds and TCE on gross fractionation of carbon isotopes as measured in the resulting CO2; 3) test the carbon isotope method for its ability to differentiate the source of the CO2 resulting from aerobic biodegradation; and 4) use samples from an appropriately contaminated bioventing site. Different degrees of fractionation were measured in both pure and mixed cultures for the different compounds tested in this study. Fractionation for toluene was slightly more negative than the starting compound. For JP-4, the fractionation of JP-4 resulted in d13C values much more negative than the starting compound. Fractionation for TCE results in d13C values more positive, indicating the CO2 had a higher percentage of 13C than the source compound. A mixture of toluene and TCE had a d13C value intermediate between the two. These results indicate, with the d13C values for these co-substrates and chlorinated ethenes sufficiently different, the degradation of one or the other can be determined. When both are being degraded an intermediate value can be obtained.
DTIC
JP-4 Jet Fuel; Fractionation; Biodegradation; Aerobes

19990025944 Dayton Univ., OH USA
Periodically-Poled Lithium Niobate for Spectroscopic Applications ***Final Report, 15 Mar. 1997 - 14 Mar. 1998***
Dominic, Vince; Dec. 21, 1998; 12p; In English
Contract(s)/Grant(s): Proj-3484
Report No.(s): AD-A358807; AFRL-SR-BL-TR-98-0861; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The Coherent Infinity laser was utilized in two different experimental investigations. One investigation was led by Andy Zakel and investigated pumping periodically-poled lithium niobate (PPLN) optical parametric oscillators (OPO's) and amplifiers (OPA's) with the Infinity laser while simultaneously seeding the OPO with the narrowband output of a tunable laser diode. The second investigation was led by Prof Peter Powers and investigated a widely tunable, narrow band spectroscopic source based on optical parametric generation (OPG) followed by optical parametric amplification. The details of the two separated investigations are given below.
DTIC
Narrowband; Parametric Amplifiers; Semiconductor Lasers; Spectroscopy; Tunable Lasers

19990025945 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
I. Trace Analysis of NO/NO2 Mixtures by Laser Photofragmentation/ Fragment Photoionization Spectrometry at Visible Wavelengths ***Final Report, Sep. 1994 - Oct. 1995***
Sausa, R. C.; Simeonsson, J. B.; Dec. 1998; 35p; In English; Prepared in collaboration with Iowa Univ., Iowa City, IA.
Contract(s)/Grant(s): Proj-1L161102AH43
Report No.(s): AD-A358821; ARL-TR-1857; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Trace concentrations of NO and NO2 molecules are differentiated spectrally using a visible dye laser and a simple flow cell with a pair of miniature electrodes for ion detection. NO is detected near 452 nm by (2+2) resonance-enhanced multiphoton ionization via its A2SIGMA(+) - X2II (0,0) transitions, while NO2 is detected by laser photofragmentation with subsequent fragment NO ionization via the A2SIGMA(+) - X2II (0,0) and (1,1) transitions. Spectral differentiation is possible since the internal energy of the NO photofragment differs from that of "ambient" NO. Measurement of vibrationally excited NO via its A2SIGMA(+) - X2II (0,3) band is also demonstrated at 517 nm. Rotationally resolved spectra of NO and fragment NO are analyzed using a multiparameter computer program based on two-photon energy-level expressions and line strengths for A2SIGMA(+) - X2II transitions. Boltzmann analysis of the P12 + O22 branch of the (0,0) band reveals that the rotational temperature of fragment NO is approximately 500 K compared to room temperature NO. Limits of detection (S/N = 3) of NO and NO2 are in the 20-40-ppbv range at 449.2, 450.7, and 452.6 nm for a 10-s integration time. The limit of detection of NO2 at 517.5 nm is 75 ppbv. The analytical utility of the technique for ambient air analysis is evaluated and discussed.
DTIC
Computer Programs; Detection; Dye Lasers; Electrodes; Energy Levels; Fragments; Internal Energy; Ionization

19990025960 Pennsylvania State Univ., University Park, PA USA
Theoretical and Experimental Approach to Developing Improved Electrical Contacts to GaN ***Final Report, 1 Sep. 1995 - 30 Sep. 1998***
Mohney, Suzanne; Jan. 04, 1999; 33p; In English
Contract(s)/Grant(s): F49620-95-1-0516
Report No.(s): AD-A358804; AFRL-SR-BL-TR-98-0863; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The metallurgy and electrical performance of contacts to GaN were examined. Thermodynamic estimates coupled with experimental work revealed clear trends in the nature of the contact metallurgy depending upon the position of the metal in the

periodic table. This information was then used to aid in the investigation and design of electrical contacts to GaN. Ohmic contacts to n-GaN, Schottky barriers to n-GaN, and ohmic contacts to p-GaN were fabricated and characterized. These studies resulted in an improved understanding of the mechanism of ohmic contact formation in Al/Ti/n-GaN contacts, along with the development of TiN/Ti/n-GaN and ZrN/Zr/n-GaN ohmic contacts with exceptional thermal stability at 600 deg C and contact resistivities of 6 x 10(exp -6) and 2 x 10(exp -5) ohm.sq cm, respectively, for n = 7 x 10(exp 17) cu cm. Also developed were Re/n-GaN Schottky barrier contacts that were stable upon annealing at 700 deg C with current-voltage and capacitance-voltage barrier heights of 0.82 and 1.06 eV, respectively. For ohmic contacts to p-GaN, a large number of contacts were evaluated. A clear improvement over conventional Au/Ni/p-GaN contacts was provided by electrodeposited Pt/p-GaN and sputtered Pt/Ni/p-GaN contacts, which provided contact resistivities that were lower than Au/Ni/p-GaN contacts by more than a factor of two. An explanation for this improvement was formulated.
DTIC
Annealing; Capacitance-Voltage Characteristics; Electric Potential; Electrical Properties; Electrodeposition; Thermal Stability

19990026070 Joint Publications Research Service, Arlington, VA USA
JPRS Report: Science and Technology. USSR: Chemistry
Aug. 29, 1991; 39p; In English
Report No.(s): AD-A344255; JPRS-UCH-91-009; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This current JPRS report contains information concerning technology relating to USSR's chemical research. Topics include: analytical chemistry, catalysis, colloids, combustion and explosives, electrochemistry, environmental chemistry, fertilizers, inorganic compounds, materials research, organophosphorous compounds, pesticides and herbicides, polymers and rubber, and radiation chemistry.
CASI
Research and Development; U.S.S.R.; Analytical Chemistry; Electrochemistry; Environmental Chemistry; Inorganic Chemistry; Radiation Chemistry; Catalysis

19990026071 Joint Publications Research Service, Arlington, VA USA
JPRS Report: Science and Technology. USSR: Chemistry
Sep. 26, 1991; 41p; In English
Report No.(s): AD-A344254; JPRS-UCH-91-010; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This report contains information concerning technology relating to USSR's chemical research. Topics include: analytical chemistry, catalysis, colloids, combustion and explosives, electrochemistry, environmental chemistry, fertilizers, inorganic compounds, materials research, organophosphorous compounds, pesticides and herbicides, polymers and rubber, and radiation chemistry.
CASI
Research and Development; U.S.S.R.; Analytical Chemistry; Electrochemistry; Environmental Chemistry; Inorganic Chemistry; Radiation Chemistry

19990026141 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Proceedings of the conference on electrochemistry of carbon allotropes: Graphite, fullerenes and diamond
Kinoshita, K., Department of Energy, USA; Scherson, D., Department of Energy, USA; Feb. 01, 1998; 25p; In English; Electrochemistry of carbon allotropes: graphite, fullerenes and diamond
Report No.(s): DE98-054173; LBNL-41478; CONF-9710255-SUMM; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
This conference provided an opportunity for electrochemists, physicists, materials scientists and engineers to meet and exchange information on different carbon allotropes. The presentations and discussion among the participants provided a forum to develop recommendations on research and development which are relevant to the electrochemistry of carbon allotropes. The following topics which are relevant to the electrochemistry of carbon allotropes were addressed: Graphitized and disordered carbons, as Li-ion intercalation anodes for high-energy-density, high-power-density Li-based secondary batteries; Carbons as substrate materials for catalysis and electrocatalysis; Boron-doped diamond film electrodes; and Electrochemical characterization and electrosynthesis of fullerenes and fullerene-type materials. Abstracts of the presentations are presented.
NTIS
Conferences; Electrochemistry; Carbon; Graphite; Fullerenes; Diamonds

19990026143 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Comprehensive program to develop correlations for physical properties of kraft black liquor ***Final Report***
Fricke, A. L., Department of Energy, USA; Zaman, A. A., Department of Energy, USA; May 31, 1998; 510p; In English
Report No.(s): DE98-054636; DOE/CE/40740-10; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The overall objective of the program was to develop correlations to predict physical properties within requirements of engineering precision from a knowledge of pulping conditions and of kraft black liquor composition, if possible. These correlations were to include those relating thermodynamic properties to pulping conditions and liquor composition. The basic premise upon which the research was based is the premise that black liquor behaves as a polymer solution. This premise has proven to be true, and has been used successfully in developing data reduction methods and in interpreting results. A three phase effort involving pulping, analysis of liquor composition, and measurement of liquor properties was conducted.
NTIS
Correlation; Kraft Process (Woodpulp); Physical Properties

19990026149 Department of Energy, Office of Energy Research, Washington, DC USA
Time resolved studies of bond activation by organometallic complexes
Wilkens, M. J., Department of Energy, USA; May 31, 1998; 77p; In English
Report No.(s): DE98-057490; LBNL-41831; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In 1971, Jetz and Graham discovered that the silicon-hydrogen bond in silanes could be broken under mild photochemical conditions in the presence of certain transition metal carbonyls. Such reactions fall within the class of oxidative addition. A decade later, similar reactivity was discovered in alkanes. In these cases a C-H bond in non-functionalized alkanes was broken through the oxidative addition of Cp*IrH2L (Cp* = (CH3)5C5), L = PPh3, pH = C6H5 to form Cp*MLRH or of Cp*IrCO2 to form Cp*IrCORH. These discoveries opened an entirely new field of research, one which naturally included mechanistic studies aimed at elucidating the various paths involved in these and related reactions. Much was learned from these experiments but they shared the disadvantage of studying under highly non-standard conditions a system which is of interest largely because of its characteristics under standard conditions. Ultrafast time- resolved IR spectroscopy provides an ideal solution to this problem; because it allows the resolution of chemical events taking place on the femto-through picosecond time scale, it is possible to study this important class of reactions under the ambient conditions which are most of interest to the practicing synthetic chemist. Certain of the molecules in question are particularly well-suited to study using the ultrafast IR spectrophotometer described in the experimental section because they contain one or more carbonyl ligands.
NTIS
Organometallic Compounds; Activation; Chemical Bonds

19990026192 California Univ., Dept. of Materials, Santa Barbara, CA USA
Synthesis of Ceramics from Solutions: Functionally Graded Composites, Nanocomposites and Single Crystal Thin Films; Annual Technical Reports 12 Through 16 with a Summary ***Final Report, 1 Dec. 1995 - 30 Nov. 1998***
Lange, Fred F.; Jan. 1999; 80p; In English
Contract(s)/Grant(s): F49620-96-1-0003
Report No.(s): AD-A359667; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This program has emphasized two topics: (1) the crystallization of metastable, solid-solution structures, their partitioning into equilibrium structures and compositions, and the role of the metastable phase and its partitioning on forming unique, nanometer microstructures important to the mechanics of structural ceramics and their composites, and (2) the formation of single crystal thin films via spin coating single crystal substrates with solution precursors. Results for the first topic are new, namely, the discovery that diffusion limited crystallization concepts used in rapid solidification directly applies to precursors that crystallize at low temperatures during heating. This discovery is significant because solid-solutions can be greatly extended relative to high temperature synthesis and processing routes where equilibrium conditions are rapidly achieved and solid-solutions can be severely limited. Extension of solid-solution fields (and thus defect chemistries) in compositional space is important to synthesize new materials with optical and electronic properties controlled by defect chemistry and/or metastable compositions. Results for the second topic have shown that single crystal thin films can be formed on single crystal substrates with spin-on liquid precursors despite large differences in lattice parameters and/or crystal structures. Several mechanisms have been identified for the growth of single crystal thin films which are very different to the well know vapor phase epitaxy mechanisms. The significance of the second topic is that single crystal (or poly-variant single crystal) thin films of nearly any inorganic material can be produced on any non-reactive (thermodynamically or kinetically) single crystal substrate, despite crystal structure differences between the film

and substrate materials. Processing of multi-layer and/or embedded strip line architectures are possible using liquid precursor spin-on techniques for new device technologies.
DTIC
Synthesis (Chemistry); Composite Materials; Thin Films; Single Crystals; Solid Solutions; Vapor Phase Epitaxy; Ceramics; Solidification

19990026286 Department of Energy, Office of Energy Research, Washington, DC USA
Quantum scattering studies of spin-orbit effects in the Cl(sup 2)P + HCl yields ClH + Cl(suo 2)P reaction
Schatz, G. C., Department of Energy, USA; McCabe, P., Department of Energy, USA; Connor, J. N. L., Department of Energy, USA; Dec. 31, 1998; 41p; In English; Sponsored by Royal Society of Chemistry, UK
Report No.(s): DE98-057794; ANL/CHM/CP-95986; CONF-980741; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors present quantum scattering calculations for the Cl + HCl yields ClH + Cl reaction in which they include the three electronic states that correlate asymptotically to the ground state of Cl(sup 2)P + HCl(X(exp 1) (Sigma)(sup +)). The potential surfaces and couplings are taken from the recent work of C.S. Maierle, G.C. Schatz, M.S. Gordon, P. McCabe and J.N.L. Connor, J. Chem. Soc. Farad. Trans. (1997. They are based on extensive ab initio calculations for geometries in the vicinity of the lowest energy saddle point, and on an electrostatic expansion (plus empirical dispersion and repulsion) for long range geometries including the van der Waals wells. Spin-orbit coupling has been included using a spin-orbit coupling parameter lambda that is assumed to be independent of nuclear geometry, and Coriolis interactions are incorporated accurately. The scattering calculations use a hyperspherical coordinate coupled channel method in full dimensionality. AJ-shifting approximation is employed to convert cumulative reaction probabilities for total angular momentum quantum number J = 1/2 into state selected and thermal rate coefficients. Two issues have been studied: (a) the influence of the magnitude of lambda on the fine-structure resolved cumulative probabilities and rate coefficients (the authors consider lambda's that vary from 0 to +/- 100% of the true Cl value), and (b) the transition state resonance spectrum, and its variation with lambda and with other parameters in the calculations. Cl + HCl is a simple hydrogen transfer reaction which serves as a canonical model both for heavy-light-heavy atom reactions, and for the reactions of halogen atoms with closed shell molecules.
NTIS
Quantum Numbers; Scattering; Hydrochloric Acid; Chlorine; Hydrogen

19990026375 Department of Energy, Washington, DC USA
Structure of mix in a rayleigh-taylor unstable fuild cell
Schneider, M. B., Department of Energy, USA; Dimonte, G., Department of Energy, USA; Remington, B. A., Department of Energy, USA; Sep. 02, 1997; 9p; In English
Report No.(s): DE98-051279; UCRL-JC-125402; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Laser-induced fluorescence is used to image the central plane of the mix region of two immiscible liquids subject to the Rayleigh-Taylor instability. The familiar bubbles and spikes display a complex internal structure. This small-scale structure creates a large contact area whose density is constant in time. The size of the mixing zone, defined in a new way, grows with coefficient ab &gt = 0.054.
NTIS
Solvents; Taylor Instability; Laser Induced Fluorescence; Liquids; Electrochemical Cells; Fluorescence

19990026393 Department of Energy, Office of Financial Management and Controller, Washington, DC USA
Selective, deep Si trench etching with dimensional control
Shul, R. J., Department of Energy, USA; Willison, C. G., Department of Energy, USA; Zhang, L., Department of Energy, USA; Dec. 31, 1998; 10p; In English; Micromachining and microfabrication
Report No.(s): DE98-006147; SAND-98-0490C; CONF-980918; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The recent development of a high-aspect ratio Si etch (HARSE) process has enabled the fabrication of a variety of Si structures where deep trench etching is necessary. The HARSE process relies on the formation of a sidewall etch inhibitor to prevent lateral etching of the Si structures during exposure to an aggressive SF6/Ar plasma etch chemistry. The process yields highly anisotropic profiles with excellent dimensional control for high aspect ratio features. In this study, Si etch rates and etch selectivities to photoresist are reported as a function of chamber pressure, cathode rf-power, ICP source power, and gas flow. Si etch rates > 3

(micro)m/min with etch selectivities to resist > 75:1 were obtained. Lateral dimensional control, etch selectivities to SiO2 and Si3N4, and aspect ratio dependent etching (ARDE) will also be discussed.
NTIS
Etching; Dimensions; Silicon

19990026457 Department of the Navy, Washington, DC USA
Thermal Stabilization of N,N-Dinitramide Salts
Russell, Thomas P., Inventor; Mishra, Indu B., Inventor; Jul. 14, 1998; 9p; In English; Supersedes US-Patent-Appl-SN-708001, AD-D018222.
Patent Info.: Filed 26 Aug. 96,; US-Patent-Appl-SN-708,001; US-Patent-5,780,769
Report No.(s): AD-D019218; No Copyright; Avail: US Patent and Trademark Office, Microfiche

The thermal stability of an N,N-dinitramide salt of the formula M(+)N(NO2)2(-) where M(+) is a nitrogen-containing cation is improved by mixing with the N,N-dinitramide salt a prophosphatrane compound. A new composition of matter is formed by mixing the N,N-dinitramide salt and the prophosphatrane compound.
DTIC
Thermal Stability; Explosives; Nitrogen

19990026460 Department of the Navy, Washington, DC USA
Zinc Oxide Stabilized Zirconia
Qadri, Syed B., Inventor; Skelton, Earl F., Inventor; Lubitz, Peter, Inventor; Sep. 01, 1998; 4p; In English; Supersedes US-Patent-Appl-SN-806375, AD-D018631.
Patent Info.: Filed 27 Feb. 97,; US-Patent-Appl-SN-806,375
Report No.(s): AD-D019221; PAT-5,800,934; No Copyright; Avail: US Patent and Trademark Office, Microfiche

Zinc oxide stabilized zirconia containing zirconia in cubic phase is prepared by evaporating zirconia and zinc oxide and depositing zirconia and zinc oxide on an atomic scale on a substrate. The stabilized zirconia resists corrosion at high temperatures above 1000 deg C., can be used as a part of a barrier coating, is transparent to visible light, and is electrically conducting.
DTIC
Zinc Oxides; Zirconium Oxides; Protective Coatings; Corrosion

19990026462 Department of the Navy, Washington, DC USA
Process for Removing Hydrogen and Carbon Impurities from Glasses by Adding a Tellurium Halide
Sanghera, Jasbinder S., Inventor; Nguyen, Vinh Q., Inventor; Aggarwal, Ishwar D., Inventor; Jul. 14, 1998; 11p; In English
Patent Info.: Filed 26 Jun. 96,; US-Patent-Appl-SN-670,910; US-Patent-5,779,757
Report No.(s): AD-D019224; No Copyright; Avail: US Patent and Trademark Office, Microfiche

Hydrogen and/or carbon impurities are removed from chalcogenide or chalcohalide glasses by the addition of a halide, such as TeCl4, to the batch composition. During melting of the batch composition, the metal halide reacts with the hydrogen and/or carbon impurities to form a hydrogen halide and/or carbon tetrahalide gas and a metal which becomes incorporated into the chalcogen-based glass. Useful halides include halides of sulfur, selenium, tellurium, polonium, or halides of a metal (such as aluminum, magnesium, zirconium, or a mixture thereof) that forms a stable oxide. Mixed metal halides may also be used. The glass melt is then distilled, outgassed, homogenized, fined, and annealed. An apparatus specially designed for making a fiber preform by the above process is also described. An annealed preform made by this method may be drawn into a low-loss fiber in the 2 microns to 12 microns range.
DTIC
Fiber Optics; Glass Fibers; Metal Halides; Tellurium

19990026593 Department of Energy, Washington, DC USA
Amine templated zinc phosphates phases for membrane separations
Nenoff, T. M., Department of Energy, USA; Chavez, A. V., Department of Energy, USA; Thoma, S. G., Department of Energy, USA; Provencio, P., Department of Energy, USA; Harrison, W. T. A., Department of Energy, USA; Dec. 31, 1998; 9p; In English, USA; Sponsored by Materials Research Society, USA
Report No.(s): DE98-005081; SAND-98-1724C; CONF-980405; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This research is focused on developing inorganic molecular sieve membranes for light gas separations such as hydrogen recovery and natural gas purification, and organic molecular separations, such as chiral enantiomers. The authors focus on zinc

phosphates because of the ease in crystallization of new phases and the wide range of pore sizes and shapes obtained. With hybrid systems of zinc phosphate crystalline phases templated by amine molecules, the authors are interested in better understanding the association of the template molecules to the inorganic phase, and how the organic transfers its size, shape, and (in some cases) chirality to the bulk. Furthermore, the new porous phases can also be synthesized as thin films on metal oxide substrates. These films allow one to make membranes from organic/inorganic hybrid systems, suitable for diffusion experiments. Characterization techniques for both the bulk phases and the thin films include powder X-ray diffraction, TGA, Scanning Electron Micrograph (SEM) and Electron Dispersive Spectrometry (EDS).
NTIS
Phosphates; Hydrogen; Materials Recovery; Research; Product Development; Purification; Zinc Compounds; Absorbents

19990026657 Department of Energy, Assistant Secretary for Nuclear Energy, Washington, DC USA
Applications of high resolution ICP-AES in the nuclear industry
Johnson, S. G., Department of Energy, USA; Giglio, J. J., Department of Energy, USA; Goodall, P. S., Department of Energy, USA; Cummings, D. G., Department of Energy, USA; Dec. 31, 1998; 11p; In English; BIOS '98: Biomedical Optics, 1998, USA
Report No.(s): DE98-057809; ANL/ED/CP-95703; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Application of high resolution ICP-AES to selected problems of importance in the nuclear industry is a growing field. The advantages in sample preparation time, waste minimization and equipment cost are considerable. Two examples of these advantages are presented in this paper, burnup analysis of spent fuel and analysis of major uranium isotopes. The determination of burnup, an indicator of fuel cycle efficiency, has been accomplished by the determination of La-139 by high resolution inductively coupled plasma atomic emission spectroscopy (HR-ICP-AES). Solutions of digested samples of reactor fuel rods were introduced into a shielded glovebox housing an inductively coupled plasma (ICP) and the resulting atomic emission transmitted to a high resolution spectrometer by a 31 meter fiber optic bundle. Total and isotopic U determination by thermal ionization mass spectrometry (TIMS) is presented to allow for the calculation of burnup for the samples. This method of burnup determination reduces the time, material, sample handling and waste generated associated with typical burnup determinations which require separation of lanthanum from the other fission products with high specific activities. Work concerning an alternative burnup indicator, U-236, is also presented for comparison. The determination of U-235: U-238 isotope ratios in U-Zr fuel alloys is also presented to demonstrate the versatility of HR-ICP-AES.
NTIS
Plasmas (Physics); Atomic Spectra; Emission Spectra; Nuclear Fuels; Mass Spectroscopy

19990026715 Boeing Defense and Space Group, Seattle, WA USA
Environmentally Benign Sol-Gel Surface Treatment for Aluminum Bonding Applications ***Final Report, May 1993 - Mar. 1996***
Osborne, Joseph H.; Blohowiak, Kay Y.; Sekits, Donald F.; Apr. 22, 1996; 34p; In English
Contract(s)/Grant(s): F33615-93-C-5322; AF Proj. 2418
Report No.(s): AD-A359956; WL*-TR-95-4060; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A surface treatment process for aluminum using sol-gel chemistry has been developed that produces strong adhesive bonds without the rinse water requirements of traditional anodizing or etching processes. In this process, an acid catalyzed sol composed of zirconium alkoxide and a silane coupling agent in water was applied to etched or grit blasted aluminum substrates by immersion or spraying. After drying at 212 deg F for 1 hour, panels were primed with Cytec BR127 or XBR6757 (nonchromated, waterborne) primer and bonded in an autoclave using Hysol 9628 adhesive. The ASTM D 3762 Wedge Test was used to screen performance. The waterbased sol-gel formulation has superior performance to more traditional alcohol-based formulations used early in this program. The best formulation, using glycidoxytrimethoxysilane as the coupling agent, showed less than 0.25 inch crack extension after exposure to 140 deg F and 100% relative humidity for 336 hours. Failure in the crack growth region appears to be cohesive. In general, the waterborne XBR6757 showed better performance than the solvent based BR127. Further characterization of the coating is needed to understand interaction effects between adherend alloy, surface preparation, sol preparation, and application technique.
DTIC
Aluminum Alloys; Adhesive Bonding; Sol-Gel Processes; Environment Protection; Surface Properties

19990026722 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
Flame Velocimetry Measurements of Inhibited Methane/Oxygen Flames Using Pulsed Flame Velocimetry, ***9 - 11 May 1995***
McNesby, Kevin L.; Daniel, Robert G.; Miziolek, Andrzej W.; Babushok, V. I.; Cheskis, Sergei; May 11, 1995; 14p; In English
Report No.(s): AD-A359994; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Knowledge of flame velocities is an important factor in the design and construction of many devices involving combustion phenomena. We report here results of flame velocity measurements obtained using pulsed flame velocimetry, a new technique that may be useful for Halon replacement research. The method developed here is based on and is an extension of the pulsed flame photometer detector developed at Tel Aviv University. Flame velocities for burning methane/oxygen mixtures to which a small amount of inhabitant has been added are determined using pulsed flame velocimetry. Results are compared to flame velocities measured for similar mixtures using other techniques. Relative flame velocities for burning methane/oxygen mixtures doped with small amounts of inhibitants are compared with velocimetry as a predictive technique for inhibitor efficiency studies is discussed.
DTIC
Velocity; Methane; Pulses; Oxygen; Combustion Physics; Gas Mixtures

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METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

19990025283 Naval Surface Warfare Center, Carderock Div., Bethesda, MD USA
Spray Formed Ni-Cr Alloys for Shipboard Waste Incinerators
Kohler, Leslie K.; Aprigliano, Louis F.; Madden, Craig J.; Oct. 1998; 21p; In English
Contract(s)/Grant(s): Proj-3450
Report No.(s): AD-A359197; NSWCCD-61-TR-1998/25; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Naval Surface Warfare Center, Carderock Division, (NSWCCD) has produced several spray formed Ni-Cr alloys in a research effort to identify a replacement for conventionally processed Alloy 690 (60Ni-30Cr-9.5Fe) waste incinerator liners. Six alloys with chromium contents ranging from 37 to 50 weight percent were chosen for evaluation; 61.5Ni-37Cr-1.5Nb, 55.5Ni-43Cr-1.5Zr, 55.5Ni-43Cr-1.5Nb, Alloy 671 (52Ni-48Cr), 48.5Ni-50Cr-1.5Nb, and 50Ni-50. These spray formed materials were characterized microstructurally and evaluated for strength, ductility, and hot workability. These measurements were compared with both conventional and spray formed Alloy 690 values. Room and high temperature tensile properties showed that as-sprayed Ni-Cr alloys with chromium contents of 43% or greater exhibited mechanical properties that were equivalent to or better than typical values for wrought Alloy 690. This has identified these materials as candidates for corrosion testing and possible replacement of Alloy 690. It is expected that higher chromium contents will improve corrosion resistance. Hot rolling of the spray formed high chromium alloys was performed easily under laboratory conditions, showing that these alloys in the spray formed condition can endure post processing without brittle cracking problems. This hot working improved the mechanical properties to values that exceeded their conventional wrought counterparts for both strength and ductility. This shows that any of the alloys in their spray formed and hot worked condition can be considered as possible replacements for Alloy 690, and should be subjected to corrosion tests.
DTIC
Chromium Alloys; Corrosion Resistance; Nickel Alloys; Incinerators

19990025877 Department of Energy, Office of Energy Research, Washington, DC USA
Metallurgical Bonding Development of V-4Cr-4Ti Alloy for the DIII-D Radiative Divertor Program
Smith, J. P., Department of Energy, USA; Johnson, W. R., Department of Energy, USA; Trester, P. W., Department of Energy, USA; Jan. 31, 1998; 11p; In English; 8th; Fusion reactor materials
Report No.(s): DE98-002632; GA-A22741; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

General Atomics (GA), in conjunction with the Department of Energy's (DOE) DIII-D Program, is carrying out a plan to utilize a vanadium alloy in the DIII- D tokamak as part of the DIII-D Radiative Divertor (RD) upgrade. The V-4Cr-4Ti alloy has been selected in the US as the leading candidate vanadium alloy for fusion applications. This alloy will be used for the divertor fabrication. Manufacturing development with the V-4Cr-4Ti alloy is a focus of the DIII-D RD Program. The RD structure, part of which will be fabricated from V-4Cr-4Ti alloy, will require many product forms and types of metal/metal bonded joints. Metallurgical bonding methods development on this vanadium alloy is therefore a key area of study by GA. Several solid state (non-fusion weld) and fusion weld joining methods are being investigated. to date, GA has been successful in producing ductile, high strength, vacuum leak tight joints by all of the methods under investigation. The solid state joining was accomplished in air, i.e., without the need for a vacuum or inert gas environment to prevent interstitial impurity contamination of the V-4Cr-4Ti alloy.
NTIS
Vanadium Alloys; Diverters; Electron Beam Welding; Titanium Alloys; Chromium Alloys; Welded Joints; Bonding

19990025878 Department of Energy, Office of Energy Research, Washington, DC USA

Fabrication of a 1,200 kg Ingot of V-4Cr-4Ti alloy for the DIII-D Radiative Divertor Program

Johnson, W. R., Department of Energy, USA; Smith, J. P., Department of Energy, USA; Jan. 31, 1998; 13p; In English; 8th; Fusion reactor materials

Report No.(s): DE98-002633; GA-A22740; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Vanadium chromium titanium alloys are attractive materials for fusion reactors because of their high temperature capability and their potential for low neutron active and rapid activation decay. A V-4Cr-4Ti alloy has been selected in the US as the current leading candidate vanadium alloy for future use in fusion reactor structural applications. General Atomics (GA), in conjunction with the Department of Energy's (DOE) DIII-D Program, is carrying out a plan for the utilization of this vanadium alloy in the DIII-D tokamak. The plan will culminate in the fabrication, installation, and operation of a V-4Ti alloy structure in the DIII-D Radiative Divertor (RD) upgrade. The deployment of vanadium alloy will provide a meaningful step in the development and technology acceptance of this advanced material for future fusion power devices. Under a GA contract and material specification, an industrial scale 1200 kg heat (ingot) of a V-4Cr-4Ti alloy has been produced and converted into product forms by Wah Chang of Albany, Oregon (WCA). to assure the proper control of minor and trace impurities which affect the mechanical and activation behavior of this vanadium alloy, selected lots of raw vanadium base metal were processed by aluminothermic reduction of high purity vanadium oxide, and were then electron beam melted into two high purity vanadium ingots. The ingots were then consolidated with high purity Cr and Ti, and double vacuum-arc melted to obtain a 1,200 kg V-4Cr-4Ti alloy ingot. Several billets were extruded from the ingot, and were then fabricated into plate, sheet, and rod at WCA. Tubing was subsequently processed from plate material.

NTIS

Fabrication; Ingots; Vanadium Alloys; Titanium Alloys; Chromium Alloys; Divertors (Fusion Reactors)

19990025918 Carnegie-Mellon Univ., Dept. of Materials Science and Engineering, Pittsburgh, PA USA

The Effects of Retained Austenite on the Tensile Properties and Toughness of Ultra-High Strength Martensitic Precipitation Hardened Stainless Steels ***Final Report, 1 Apr. 1997 - 31 Mar. 1998***

Garrison, Warren M.; Dec. 14, 1998; 47p; In English

Contract(s)/Grant(s): F49620-97-1-0156

Report No.(s): AD-A359406; AFRL-SR-BL-TR-99-0024; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this work was to assess the effects of the amount of retained austenite content on the ductile-to-brittle transition temperature of martensitic precipitation strengthened stainless steels for four different precipitation strengthening systems, one utilizing NiTi strengthening and three utilizing R-phase strengthening. The retained austenite contents in the four systems were varied by varying composition. The austenite content in the NiTi strengthened system was varied by varying the chromium content and the austenite content in the R-phase strengthened Systems was varied by varying the nickel content. The room temperature toughness levels of the NiTi strengthened system were quite low and it was decided not to pursue this system further. The three R-phase strengthened systems had sufficient room temperature toughness and strength to be of further interest. of these three systems the primary focus was on the 12Cr/12Co/5Mo system. In this system four alloys, identical except for variations in nickel content, were the primary focus of the work. These alloys achieved, on tempering at 5250 C for 3.16 hours, yield strengths on the order of 210 ksi and ultimate tensile strengths of 235 ksi. The effect of test temperature on the Charpy impact energy was investigated for two tempering temperatures for these four alloys. It was found for both tempering conditions that lower ductile-to-brittle transition temperatures were favored by increasing amounts of austenite in the structure. In fact, the ductile-to-brittle transition temperature was quite low, about -750 C, for the tempered at 5250 C for 3.16 hours microstructure of the alloy in this series which contained the highest nickel and the highest amount of retained austenite after quenching. At this point it is believed the austenite content is an important contributor to the low ductile-to-brittle transition temperature of this microstructure.

DTIC

Tensile Properties; Precipitation; Hardening; High Strength Alloys; Austenite; Martensitic Stainless Steels; Nickel Alloys

19990025943 Naval Postgraduate School, Monterey, CA USA

Beam Shape Control Using Shape Memory Alloys

Kelly, Brian L.; Dec. 1998; 76p; In English

Report No.(s): AD-A358806; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This thesis presents the design and experimental results of active position control of a shape memory alloy (SMA) wire and a SMA wire actuated composite beam. The wire is a single SMA Nickel Titanium wire mounted on a single wire test stand. The composite beam is aluminum honeycomb with SMA wires embedded in one of its face sheets for active shape control. The potential applications of this experiment include thermo-distortion compensation for precision space structures, stern shape control for

submarines, and flap shape control for aeronautical applications. SMA wires are chosen as actuating elements due to their high recovery stress (> 700 MPa) and its tolerance to high strain (up to 8%). SMA wires are inherently nonlinear, which poses a challenge for control design. The experimental setup consists of the single wire test stand and the composite beam with embedded SMA wires, a HP programmable power supply, a Linear Variable Differential Transformer (LVDT), an intrared laser range sensor, and a dSpace system with a Texas Instrument C-30 DSP for data acquisition and real-time control. A Position and Derivative (PD) control with feed forward action was designed and implemented, and a control accuracy of 0.1 mm was achieved. A non-linear control was added which gives a control accuracy of 0.05 mm with a much faster response.
DTIC
Active Control; Afterbodies; Aircraft Control; Aluminum; Data Acquisition; Derivation; Distortion; Submarines; Transformers

19990025970 Department of Energy, Office of Energy Research, Washington, DC USA
First-principles exchange interactions between ferro and antiferromagnetic films: Co on NiMn, a case study
Schulthess, T. C., Department of Energy, USA; Butler, W. H., Department of Energy, USA; Dec. 31, 1997; 13p; In English; 7th; Joint MMM-Intermag Conference
Report No.(s): DE98-000898; ORNL/CP-95042; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Heisenberg exchange parameters at the interface of antiferromagnetic NiMn with ferromagnetic Co are calculated from first-principles. The authors use a layer version of the Korringa-Kohn-Rostocker multiple scattering approach and an expression, which is based on the expansion of the band energy, to calculate the exchange parameters from the underlying electronic structure. For bulk systems, the parameter sets yield Curie temperatures that are in good agreement with experimental values. In the interface region, the inter-layer interactions in NiMn change significantly compared to the bulk while the intra-layer interactions are almost unchanged.
NTIS
Antiferromagnetism; Energy Transfer; Cobalt; Nickel Alloys; Manganese Alloys; Ferromagnetic Films

19990026003 Department of Energy, Washington, DC USA
Materials corrosion and mitigation strategies for APT, end of FY 1997 report: Inconel 718 in-beam corrosion rates from the 1997 A6 irradiation
Lillard, R. S., Department of Energy, USA; Pile, D. L., Department of Energy, USA; Butt, D. P., Department of Energy, USA; Dec. 31, 1998; 37p; In English
Report No.(s): DE98-003683; LA-UR-98-764; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This report summarizes the results from the 1997 irradiation of the corrosion insert at the LANSCE A6 Target Station. It addresses the corrosion measurements made on the in-beam Inconel 718 probe only. to simulate the environment that materials may be exposed to in a spallation neutron target/blanket cooling loops, samples were irradiated by the proton beam at the A6 Target Station of the Los Alamos Neutron Scattering Center (LANSCE). EIS measurements have demonstrated that the polarization resistance of IN718 decreases from approximately 3 x 10(sup 5) ohms prior to irradiation to approximately 1,000 ohms during irradiation at a proton beam current of 400 (micro)A. From the polarization resistance measurements, corrosion rate as a function of beam current was calculated for several different scenarios of beam/sample interaction. As the beam spot was small relative to the size of the IN718 corrosion probe (2(sigma) = 3 cm vs. 1.3 cm diam. x 15.9 cm length respectively), The first method for calculating corrosion rate used beam profile as a criterion for the area of highest damage. The beam spot intensity profile at LANSCE has been characterized and found to be a Gaussian distribution rotated about a central axis. From this relationship, and R(sub p) as a function of beam current, corrosion rate as a function of radial distance from the center of the beam was calculated for each beam current. Physical evidence from change in thickness measurements made on tungsten rods irradiated at 1 mA during the FY 96 irradiation period suggest that this Gaussian damage profile is an accurate depiction of beam/sample interaction. From this method the corrosion rate of IN718 during irradiation at a beam current of 1.0 mA is calculated to be approximately 0.002 inches per yr (2 mpy). The second method assumed that the predominant contributor to the corrosion current comes from an area defined by 2(sigma). Further, the method assumed that the corrosion rate was uniform over this area. Specifically, the R(sub p) was multiplied by the area (pi)d x 2(sigma) where d was the diameter of the probe and equal to 1.3 cm. From this method the corrosion rate of IN718 during irradiation at a beam current of 1.0 mA is calculated to be approximately 0.001 inches per yr (1 mpy) . The third method to calculate corrosion rate assumed that the distribution of corrosion was uniform across the entire surface. to calculate CR, the measured polarization resistance (R(sub p)) was multiplied by the total probe area (approximately 63.3 cm(sup 2)). From this method the corrosion rate of IN718 during irradiation at a beam current of 1.0 mA is calculated to be approximately 0.0002 inches per yr (0.2 mpy). However, this rate is non-conservative and may be viewed only as a minimum corrosion rate.
NTIS
Corrosion; Beam Interactions; Irradiation; Inconel (Trademark)

19990026004 Department of Energy, Office of Energy Research, Washington, DC USA
Growth induced magnetic anisotropy in crystalline and amorphous thin films
Hellman, F., Department of Energy, USA; Jul. 20, 1998; 9p; In English, USA; Sponsored by American Physical Society, USA
Report No.(s): DE98-003724; DOE/ER/45529-T2; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The work in the past 6 months has involved three areas of magnetic thin films: (1) amorphous rare earth-transition metal alloys, (2) epitaxial Co-Pt and Ni-Pt alloy thin films, and (3) collaborative work on heat capacity measurements of magnetic thin films, including nanoparticles and CMR materials. A brief summary of work done in each area is given.
NTIS
Magnetic Films; Anisotropy; Crystallinity; Amorphous Materials; Thin Films; Magnetic Materials

19990026096 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
Galvanic Corrosion of Tungsten Coupled With Several Metals/Alloys ***Final Report, 1994 - 1997***
Chang, F. C.; Beatty, J. H.; Kane, M. J.; Beck, J.; Nov. 1998; 31p; In English
Report No.(s): AD-A358781; ARL-TR-1845; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

From an environment perspective, tungsten is a more desirable material than depleted uranium (DU) for penetrator applications. However, the ballistic performance attained by current tungsten (W) alloys is inferior to DU. Recently, advanced tungsten-metal (W-M) composites have been developed to improve their ballistic penetration, but the corrosion properties are unknown and need to be determined. In this work, the galvanic corrosion behavior of W coupled with several selected metals/alloys was investigated. Electrochemical potentiodynamic polarizations and galvanic couplings were employed. The testing was conducted in a 1 wt-% sodium sulfate solution. The selected metals/alloys were: pure W, pure titanium (Ti), Ti 6Al-4V (Ti-6-4), hafnium (Hf), 36Ni64FeO.03C (Invar), pure iron (Fe), and brass (CDA 260). The galvanic corrosion of these couples is examined and discussed based on the results from electrochemical tests and visual observations.
DTIC
Ballistics; Brasses; Corrosion; Couples; Couplings; Electrochemical Corrosion; Hafnium; Human Behavior

19990026240 Department of Energy, Washington, DC USA
Multilayer coating and tests of a 10x extreme ultraviolet lithographic camera
Spiller, E., Department of Energy, USA; Weber, F. J., Department of Energy, USA; Montcalm, C., Department of Energy, USA; Baker, S. L., Department of Energy, USA; Gullikson, E. M., Department of Energy, USA; Feb. 19, 1998; 13p; In English; 23rd; Microlithography; Sponsored by International Society for Optical Engineering, USA
Report No.(s): DE98-057751; UCRL-JC-128291; CONF-980225; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A new set of mirrors for the SANDIA I OX microstepper has been fabricated. The optics have been tested by optical profilometry, atomic force microscopy, EUV reflectometry and EUV scattering. These measurements allow one to predict the performance of the camera. Mo/Si multilayer coatings with the required thickness profile were produced by DC magnetron sputtering using shadow masks in front of the rotating substrates. The failure errors of the new mirrors 0.6 nm are considerably smaller than those obtained previously, while mid-spatial frequency roughness still needs improvement. This roughness reduces mostly the throughput of the system; i. e. most of the scattered light occurs outside the field of the camera and there is only a small reduction of contrast or resolution.
NTIS
Coating; Cameras; Extreme Ultraviolet Radiation; Lithography

19990026241 Department of Energy, Washington, DC USA
Mechanical properties of Cu/Ta multilayers prepared by magnetron sputtering
Nguyen, T. D., Department of Energy, USA; Barbee, T. W., Department of Energy, USA; Apr. 01, 1998; 10p; In English; Sponsored by Materials Research Society, USA
Report No.(s): DE98-057690; UCRL-JC-130782; CONF-980405; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The microstructure and mechanical properties of sputtered Cu/Ta multilayers were studied. X- ray diffraction and transmission electron microscopy characterization indicate that both the Ta and Cu in the 2 nm period multilayer are predominantly amorphous, while in longer period samples, the layers are crystalline, with the metastable tetragonal (beta)-Ta observed. No observable microstructure changes upon annealing at 300 C were found. An average Vickers micro- hardness value of about 5.5 GPa was

measured, which increases about 5% upon annealing at 300 C. Residual stress in the multilayers and its dependence on thermal annealing are reported. The relationships between microstructure and mechanical properties in the multilayers are discussed.
NTIS
Mechanical Properties; Copper Alloys; Tantalum Alloys; Magnetron Sputtering; Microstructure

19990026242 Department of Energy, Washington, DC USA
Electronic effects at interfaces in Cu-Cr, Mo, W, Ta, Re multilayers
Bello, A. F., Department of Energy, USA; Van Buuren, T., Department of Energy, USA; Kepesis, J. E., Department of Energy, USA; Barbee, T. W., Department of Energy, USA; Apr. 01, 1998; 10p; In English; Sponsored by Materials Research Society, USA
Report No.(s): DE98-057689; UCRL-JC-130781; CONF-980405; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Interfacial electronic effects between Cu and the transition metals Cr, Mo, W, Ta, Re, are investigated by determining the strength of the white line absorption resonances on the L,,, edges of Cu in Cu(sub 5)/TM(sub 5) multilayers. X-ray absorption (XAS) was performed to study the white lines, which are directly related to the unoccupied states of Cu in the multilayers. The metallic multilayers are 2 mn in period and 200 mn in total thickness. Each period contains 5 monolayers of Cu and 5 monolayers of the transition metal: 40% of the atoms are at interfaces. These material pairs form ideal structures for the investigation of interfacial electronic effects as they form no compounds and exhibit terminal solid solubility. Only weak white lines are observed on the L3,2 edges of Cu since all the d-orbitals are filled. In the Cu/TM multilayers, however, we observed enhancement of the Cu white lines. We attribute this to the charge transfer from the 'interfacial Cu atoms' d-orbital to the transition metal layers. Analysis of the white line enhancement enables calculation of the charge transfer from the Cu to the transition metal. Cu shows a charge transfer of about 0.03 electrons/interfacial Cu atom in Cu/Cr, 0.064 in Cu/Mo, 2048 0.35 in Cu/Ta, 0.17 in Cu/W , and 0.23 in Cu/Re. This charge transfer is consistent with the enhanced absorption energy of Cu on these materials as observed in thermal desorption experiments.
NTIS
Copper Alloys; Tungsten Alloys; Rhenium Alloys; Molybdenum Alloys; Chromium Alloys; Tantalum; X Ray Absorption; Interfaces

19990026258 NASA Ames Research Center, Moffett Field, CA USA
Influence of Microstructure on the Fatigue Crack Growth of A516 in Hydrogen
Wachob, Harry F., NASA Ames Research Center, USA; Nelson, Howard G., NASA Ames Research Center, USA; Proceedings of the Third International Conference on Effect of Hydrogen on Behavior of Materials; 1980, pp. 703-711; In English; 3rd; Effect of Hydrogen on Behavior of Materials, 26-31 Aug. 1980, Moran, WY, USA; Sponsored by Metallurgical Society, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Some day hydrogen may be used as a viable energy storage and transport medium within the USA. Hydrogen gas may be used to dilute and extend our present methane supply as a blend or may even be used in its pure elemental form as a primary fuel. Independent of the methods of production, storage, and distribution, the interaction of hydrogen with its containment material will play an integral role in the success of a hydrogen energy program. Presently, the selection of hydrogen containment materials can be made such that the material will remain reasonably free from environmental degradation; however, costly alloying additions are required. Unfortunately, high alloy steels are economically prohibitive when large-scale hydrogen energy storage, transmission, and conversion systems are desired. Therefore, in order to implement such hydrogen energy systems in the future, existing low-cost materials must be improved via mechanical, thermal, or thermo-mechanical processing methods or new low-cost materials which are compatible with hydrogen must be developed. Originally, low strength, low alloy steels at room temperature were thought to be immune to hydrogen gas embrittlement, since no sustained load crack growth is observed. However, results of Clark in HY8O and Nelson in SAE 1020 have shown that the fatigue crack growth rate can be greatly accelerated in the presence of hydrogen gas. In recent results reported by Louthan and Mucci, the smooth bar fatigue life of an A1068 pipeline steel was reduced up to a factor of ten when the tests were performed in a 13.8 MPa hydrogen environment. These results suggest that the selection of material for structures designed to operate in hydrogen under cyclic loads must include consideration of hydrogen/metal fatigue interaction. Although the hydrogen/metal fatigue interaction can be severe in low strength low alloy steels, the degree of degradation may be altered by the underlying ferrous microstructure. At present, no correlation between microstructure and degree of hydrogen susceptibility exists for low strength steels. However, in high strength steels, susceptibility to hydrogen embrittlement has been shown to be strongly sensitive to the metallurgical microstructure. In addition, compositional effects and grain size can 703 Some day hydrogen may be used as a viable energy storage and transport medium within the USA. Hydrogen gas may be used to dilute and extend our present methane supply as a blend or may even be used in its pure elemental form as a primary fuel. Independent of the methods of production, storage, and distribution, the interaction of hydrogen with its contain-

ment material will play an integral role in the success of a hydrogen energy program. Presently, the selection of hydrogen containment materials can be made such that the material will remain reasonably free from environmental degradation; however, costly alloying additions are required. Unfortunately, high alloy steels are economically prohibitive when large-scale hydrogen energy storage, transmission, and conversion systems are desired. Therefore, in order to implement such hydrogen energy systems in the future, existing low-cost materials must be improved via mechanical, thermal, or thermo-mechanical processing methods or new low-cost materials which are compatible with hydrogen must be developed.
Derived from text
Metal Fatigue; Microstructure; Crack Propagation; Hydrogen Embrittlement; Alloying; Fatigue Life

19990026268 Department of Energy, Office of Energy Research, Washington, DC USA
Current distributions and dissolution mechanisms during localized corrosion of steels in alkaline environments
Isaacs, H. S., Department of Energy, USA; Ryan, M. P., Department of Energy, USA; Virtanen, S., Department of Energy, USA; Schmuki, P., Department of Energy, USA; Dec. 31, 1997; 6p; In English; Understanding corrosion mechanisms of metals in concrete: a key to improving infrastructure durability
Report No.(s): DE97-008955; BNL-64659; CONF-9707111; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In situ corrosion investigations of iron were carried out in alkaline environments to determine the stages of corrosion that may be encountered with steels in concrete. The electrochemical and chemical processes taking place on Fe have been studied using x-ray absorption, current density mapping of the iron surface and artificial pits. The x-ray absorption near edge spectroscopy was used to observe the conversion of Fe to oxide in hydroxide solutions. The oxide formed was electrochemically active and changes in valence states between 2+ and 3+ were observed during electrochemical cycling between the passive state and hydrogen evolution. Current density mapping in chloride/hydroxide solution showed that corrosion took place in highly localized areas confined by the formation of a corrosion product shell. The activity within the shell decayed on removing a supporting cathodic area limiting but reactivated on its replacement. Artificial pits were used to study the anodic processes taking place within the region confined by the corrosion product shell. The local pH and anodic behavior were similar to that observed in neutral or slightly acid bulk solutions. The dissolution within the artificial pits in alkaline bulk solutions was found to be sensitive to the presence of small-quantities of nitrite.
NTIS
Current Distribution; Dissolving; Corrosion; Steels; Iron; Concretes

19990026320 Research and Technology Organization, Applied Vehicle Technology Panel, Neuilly-sur-Seine, France
Fatigue in the Presence of Corrosion *Fatigue sous Corrosion*
Fatigue in the Presence of Corrosion; March 1999; 214p; In English, 7-9 Oct. 1998, Corfu, Greece; See also 19990026321 through 19990026338; Original contains color illustrations
Report No.(s): RTO-MP-18; AC/323(AVT)TP/8; ISBN 92-837-1011-8; Copyright Waived; Avail: CASI; A10, Hardcopy; A03, Microfiche

The NATO fleets are aging in both real time and in accrued fatigue damage. Corrosion and fatigue, independently, are high cost maintenance items and both can affect airworthiness. There is a synergistic relationship between these two phenomena. Cost effective and airworthy approaches to design and corrosion prevention must be defined. Work in NATO countries could be accelerated by a sharing of experience. During the Workshop 22 papers were grouped in four sessions: Session 1, In-service Experience with Corrosion Fatigue; Session 2, Simulation/Test Evaluation Programs; Session 3, Fatigue Prediction Methodologies in Corrosive Environments; and Session 4, Structural Integrity - Corrosion and Fatigue Interactions.
Author
Fatigue (Materials); Corrosion; Service Life; Aircraft Maintenance; Corrosion Prevention; Aircraft Structures; Structural Failure; Nondestructive Tests

19990026327 Aerospatiale, Suresnes, France
Corrosion Fatigue of Aluminum Alloys: Testing and Prediction
Genkin, J.-M., Aerospatiale, France; Journet, B. G., Aerospatiale, France; Fatigue in the Presence of Corrosion; March 1999; 12p; In English; See also 19990026320; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Since the Aloha in-flight failure, the aging aircraft issue has prompted some renewed effort from the research community in the area of corrosion fatigue. This paper presents a methodology which deals with corrosion fatigue crack initiation in a pitting environment. The investigation is carried out on an aluminum lithium alloy. The obtained results shed a new light on the understanding of corrosion fatigue. Before corrosion fatigue cracks take over, the propagating flaw is a hybrid half pit / half corrosion

fatigue crack. Both pitting and corrosion fatigue contribute to the flaw growth. A predictive model has been derived. The validation was made by comparing the predictions to experimentally measured pit depths and fatigue lives. A set of guidelines is given for the prediction of in-service corrosion fatigue. It highlights the materials parameters to be evaluated and the testing conditions to use.
Author
Metal Fatigue; Corrosion; Structural Failure; Aircraft Maintenance; Aluminum Alloys; Aircraft Structures; Pitting; Lithium Alloys; Cracks; Corrosion Tests

19990026328 La Sapienza Univ., Rome, Italy
Influence of Corrosion on Fatigue Crack Growth Propagation of Aluminium Lithium Alloys
Brotzu, A., La Sapienza Univ., Italy; Cavallini, M., La Sapienza Univ., Italy; Felli, F., La Sapienza Univ., Italy; Marchetti, M., La Sapienza Univ., Italy; Fatigue in the Presence of Corrosion; March 1999; 12p; In English; See also 19990026320; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The fatigue crack propagation behaviour of three commercial Al-Li alloys (2091, 8090, and Weldalite(R) 049), supplied by the manufacturer in form of plate, have been studied. A great number of the test have been carried out in order to obtain a reliable set of data. The tests were conducted in air and 3.5%w NaCl aqueous solution at different frequencies (1, 2, 5 and 10 Hz). Fractographic examinations with a scanning electron microscope and a particular etching technique have been done in order to isolate the possible fatigue mechanisms.
Author
Fatigue (Materials); Corrosion; Aluminum Alloys; Corrosion Tests; Lithium Alloys; Crack Propagation; Fatigue Tests; Aircraft Structures

19990026329 Aluminum Co. of America, Alcoa Center, PA USA
Effect of Prior Corrosion on Fatigue Performance of Toughness Improved Fuselage Skin Sheet Alloy 2524-T3
Bray, G. H., Aluminum Co. of America, USA; Bucci, R. J., Aluminum Co. of America, USA; Golden, P. J., Purdue Univ., USA; Grandt, A. F., Purdue Univ., USA; Fatigue in the Presence of Corrosion; March 1999; 9p; In English; See also 19990026320; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Aviation industry demand for continuous safety improvement in the face of trends toward increasing service life of aircraft and cost control necessitates stronger prevention and control measures to avoid the likelihood of structural failures linked to multi-site damage (MSD) involving corrosion and fatigue. New materials with improved damage tolerance attributes can improve the margin of safety in the presence of MSD. An excellent example of one such material is new aluminum alloy 2524 (formerly C188). In this study, the effect of prior pitting corrosion on the S/N fatigue performance of thin (less than or = 3.17 mm) 2524-T3 and 2024-T3 bare sheet was evaluated in a two part study. First, smooth axial fatigue specimens were corroded by accelerated methods to approximate 1 yr seacoast exposure and then fatigue tested in lab air. The fatigue strength of 2524 was approximately 10% greater and the lifetime to failure 30 to 45% longer than that of 2024. Second, panels containing 24 open holes were similarly corroded and then fatigued in lab air for 100,000 cycles. The mean flaw areas following corrosion and fatigue were 18% smaller in 2524 and the corroded area alone 32% smaller. The results of this study indicate that thin, bare 2524 sheet is more resistant to MSD from pitting corrosion than thin, bare 2024 sheet. Alloy 2524 also offers improved structural damage tolerance in the presence of MSD due to its superior fatigue crack growth resistance and fracture toughness.
Author
Fatigue (Materials); Corrosion; Structural Failure; Aluminum Alloys; Crack Propagation; Metal Sheets; Pitting; Fuselages; Skin (Structural Member); Fatigue Tests

19990026330 Daimler-Benz Aerospace A.G., Fatigue and Fracture Mechanics Dept., Hamburg, Germany
The Effect of Environment: Durability and Crack Growth
Schmidt-Brandecker, B., Daimler-Benz Aerospace A.G., Germany; Schmidt, H.-J., Daimler-Benz Aerospace A.G., Germany; Fatigue in the Presence of Corrosion; March 1999; 9p; In English; See also 19990026320; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Structures of transport aircraft are to be designed for an optimum of weight, costs and performance. Amongst others this requires the investigation of the durability and the damage tolerance behavior of the structure. Both characteristics are significantly influenced by the environmental conditions. Additionally the load frequency has an effect on the crack growth behavior of aluminium structure. These aspects play a major role during the material selection for the next Airbus aircraft generation. For the fuselage of the planned Airbus Megaliner new materials are under consideration to comply with the forthcoming regulations

and to reduce the production costs. This paper describes the results of crack growth and crack initiation tests of several aluminium alloys under varying environment and loading frequency.
Author
Fatigue (Materials); Corrosion; Aircraft Reliability; Aluminum Alloys; Crack Initiation; Crack Propagation; Aircraft Structures; Environmental Tests; Transport Aircraft; Loads (Forces)

19990026331 Hellenic Aerospace Industry, Advanced Materials and Processes Dept., Schimatari, Greece
Combined Effect of Hydrogen and Corrosion on High Strength Aircraft Structures Under Stressed Conditions
Marioli-Riga, Z. P., Hellenic Aerospace Industry, Greece; Karanika, A. N., Hellenic Aerospace Industry, Greece; Fatigue in the Presence of Corrosion; March 1999; 10p; In English; See also 19990026320; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The embrittlement of high strength landing gear steels is attributed to hydrogen absorption during electro-chemical corrosion protection treatments. Accidents have been reported after service of high strength landing gear components at low applied cycles of stresses and have been attributed to Hydrogen Embrittlement. For evaluation of the mechanical properties reduction of high strength structures, after retreatment during maintenance, specific sustained load creep tests are carried out. When an electrochemical plated notched specimen is strained, hydrogen is carried by mobile dislocations to the root of the notch. Transient cracks formed by dislocation interaction, are stabilized by the hydrogen and stresses which would be relieved by deformation in absence of hydrogen are relieved by cracking when the hydrogen content exceeds a critical value. However, these tests provide information of mechanical behaviour based only to Hydrogen absorption. In real cases the A/C components phases a combined effect of highly corrosive environment like seawater, hydrogen and loading. The present investigation is aimed to create realistic qualification tests for high strength serviced aircraft components operated in a periodical fatigue and corrosive environment. A creep test program was developed and a series of notched specimen attacked variously by Hydrogen and corrosion salt spray have been subjected to different cycles of sustained load. The mechanism of failure was recorded and conclusions were extracted for establishing simulated qualification tests.
Author
Hydrogen Embrittlement; Corrosion; Structural Failure; Aircraft Structures; Environmental Tests; Stress Concentration; Metal Fatigue; Cracks; High Strength Steels; Landing Gear; Load Tests

19990026334 Office of Naval Research, Arlington, VA USA
Environmental Effects on Fatigue Crack Initiation and Growth
Vasudevan, A. K., Office of Naval Research, USA; Sadananda, K., Naval Research Lab., USA; Fatigue in the Presence of Corrosion; March 1999; 13p; In English; See also 19990026320; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This article discusses briefly the relative effects of the role of environment on the fatigue crack initiation and growth at ambient temperatures. Emphasis is given to describe the crack tip driving forces required to understand the basic physics. It is observed that the fatigue damage requires two driving force parameters (Delta-K and K(max)) over the entire range and that the relative role of each parameter depends strongly on the role of deformation slip and environment. The environmental effects fall into four categories that depend on the synergistic role of the environmental kinetics and deformation. The study points out that one needs the correct parameters to develop a life prediction model. The overall topics are focussed to the near threshold behavior and the concepts can be extended to higher growth rates.
Author
Fatigue (Materials); Corrosion; Structural Failure; Crack Initiation; Aircraft Reliability; Crack Propagation; Crack Tips; Environmental Tests

19990026335 Defence Evaluation Research Agency, Structural Materials Centre, Farnborough, UK
Role of Surface Pitting Corrosion on Effectiveness of Hole Cold Expansion
Cook, R., Defence Evaluation Research Agency, UK; Glinos, N., Kingston Univ., UK; Wagstaff, P., Kingston Univ., UK; Fatigue in the Presence of Corrosion; March 1999; 12p; In English; See also 19990026320; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Fatigue tests have been carried out on open hole specimens which have been cold expanded prior to or subsequent to exposure to corrosive environments. The results show that the effectiveness of hole cold expansion in enhancing fatigue endurance can be significantly reduced when cold expansion is carried out after exposure to corrosive environments. The reduction in effectiveness is associated with a change in failure location. In specimens cold expanded after exposure to corrosion, failures initiate from pits remote from the hole in an area of tensile residual stresses. Analytical models have been developed to predict the rate of crack growth from these corrosion pits which correlate well with experimental data. Models have also been developed to predict the

rate of growth of cracks from cold expanded holes which show reasonable correlation with experimental data. The findings have important implications to the aircraft industry where corrosion problems can be serious and where hole cold expansion is frequently employed in repair schemes.
Author
Fatigue Life; Corrosion; Structural Failure; Crack Propagation; Fatigue Tests; Holes (Mechanics); Mathematical Models; Pitting; Expansion

19990026336 Institute for Aerospace Research, Structures Materials and Propulsion Lab., Ottawa, Ontario Canada
An Experimental Study of Corrosion/Fatigue Interaction in the Development of Multiple Site Damage in Longitudinal Fuselage Skin Splices
Eastaugh, Graeme F., Institute for Aerospace Research, Canada; Merati, Ali A., Institute for Aerospace Research, Canada; Simpson, David L., Institute for Aerospace Research, Canada; Straznicky, Paul V., Carleton Univ., Canada; Scott, Jason P., Carleton Univ., Canada; Wakeman, R. Brett, Carleton Univ., Canada; Krizan, David V., Carleton Univ., Canada; Fatigue in the Presence of Corrosion; March 1999; 16p; In English; See also 19990026320; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

It is difficult and costly to study either the fatigue or the corrosion/fatigue behaviour of longitudinal fuselage splices using in-service aircraft or full-scale structural test articles. These studies are further complicated by variations in splice designs in different types of aircraft. Therefore, a means of performing representative experimental studies cost-effectively for different aircraft has been devised. A special uniaxial specimen developed earlier has been used to simulate the stress environment of an aircraft splice. This specimen is capable of providing representative fatigue crack initiation, growth, and link-up data for the typical multiple site damage (MSD) failure mode and for other crack scenarios. In-service corrosion has been simulated by applying an accelerated corrosion process to the interior of the splice without damaging other areas of the specimen. Combined exposure to both corrosion and fatigue has so far been simulated by pre-corroding, drying and then fatigue testing the specimen. The accelerated corrosion damage in MSD specimens has been compared with natural corrosion damage in aircraft splices and the overall experimental approach is considered to be adequately representative for an initial study of the effects of corrosion on the durability and damage tolerance characteristics of fuselage splices. The preliminary results of an exploratory test programme indicate that corrosion at levels found in some aircraft could significantly reduce the fatigue life of longitudinal fuselage splices and could cause important changes in failure modes.
Author
Corrosion; Structural Failure; Fuselages; Fatigue Life; Fatigue Tests; Failure Modes; Crack Initiation; Splicing; Aircraft Structures

19990026382 Department of Energy, Washington, DC USA
Toward optimization of the grain boundary character distribution in copper by strain annealing
King, W. E., Department of Energy, USA; Schwartz, A. J., Department of Energy, USA; Schwartz, A. J., Department of Energy, USA; Nov. 10, 1996; 11p; In English
Report No.(s): DE98-050878; UCRL-JC-126207; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

We have used a two step (low and high temperature) strain-annealing process to evolve the two grain boundary character distribution (GBCD) in fully recrystallized oxygen (OFE) copper bar that was forged and rolled. Orientation imaging microscopy (OIM) has been used to characterize the GBCD after each step in the processing. The fraction of special grain boundaries, special fraction was about 70% in the starting recrystallized material. Three different processing conditions were employed: high, moderate, and low temperature. The high temperature process resulted in a reduction in the fraction of special grain boundaries while both of the lower temperature processes resulted in an increase in special fraction up to 85%. Further, the lower temperature processes resulted in average deviation angles from exact misorientation, for special boundaries, that were significantly smaller than observed from the high temperature process. Results indicate the importance of low temperature part of the two-step strain-annealing process in preparing the microstructure for the higher-temperature anneal and commensurate increase in the special fraction. NTIS
Copper; Annealing; Optimization; Grain Boundaries; Recrystallization

19990026444 Massachusetts Inst. of Tech., Dept. of Materials Science and Engineering, Cambridge, MA USA
Single Crystal Growth and Characterization of Silicon Germanium Alloys
Rittenhouse, Tilghman L.; Jan. 25, 1999; 91p; In English
Report No.(s): AD-A360049; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Silicon and germanium exhibit complete solid solubility for all binary concentrations. However, the growth of single crystalline SiGe alloys by bulk growth processes is hindered by the relatively wide separation of the solidus and liquidus lines. Previous research has yielded single crystals grown by the Czochralski method which are limited to only a few atomic percent of solute (Si or Ge), and even these crystals must be grown slowly (on the order of a millimeter per hour). On both a macroscopic and a microscopic scale, these crystals exhibit large axial variation in the solute distribution. This research investigates Si(x)Ge(1-x) alloys with 0 less than x less than -0.05. Several growth parameters that affect axial and radial segregation as well as growth interface stability and micro segregation are investigated. Specifically, this research investigates methods to influence the Si axial composition fluctuations, minimize dislocation density in the crystal, and allow for a relatively fast growth rate while maintaining single crystalline growth. In the reported growth experiments, single crystalline growth was limited to boule concentrations of less than 1 at% Si. For this concentration range of Si, the growth rate could be varied; this work resulted in single crystalline growth for growth rates between 2 and 11 mm/hr. For the thermal configuration used, concentrations of Si higher than 1 at% resulted in all instances in polycrystalline growth regardless of the growth rate. Axial macro segregation of solute in the boule was found to lie in the middle of values reported in the literature. The effective distribution coefficient (k(eff)) of Si in the concentration range investigated was found to be 2.75. Seed rotation rate variations between 15 and 45 rpm were not found to affect the macrosegregation of solute, indicating segregation was dominated by convective currents and not a solute boundary layer (diffusion).
DTIC
Silicon Alloys; Germanium Alloys; Single Crystals; Crystal Growth; Czochralski Method

19990026653 Department of Energy, Office of Energy Research, Washington, DC USA
Applications of nonequilibrium melting concept to damage-accumulation processes
Lam, N. Q., Department of Energy, USA; Okamoto, P. R., Department of Energy, USA; Jan. 31, 1998; 10p; In English; Advanced Energy Technology, USA
Report No.(s): DE98-057816; ANL/MSD/CP-95024; CONF-980250; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors recent study of crystalline-to-amorphous transformation led to the successful development of a unified thermodynamic description of disorder-induced amorphization and heat-induced melting, based on a generalized version of the Lindemann melting criterion. The generalized criterion requires that the melting temperature of a defective crystal decreases with increasing static atomic disorder. Hence, any crystal can melt at temperatures below the melting point of its perfect crystalline state when driven far from equilibrium by introducing critical amounts of misfitting solute atoms and lattice imperfections, radiation damage, and/or tensile stresses. This conceptual approach to nonequilibrium melting provides new insight into long-standing materials problems such as brittle fracture, embrittlement, and environmentally- induced cracking, for example irradiation-assisted stress corrosion cracking.
NTIS
Melting; Radiation Damage; Thermodynamics; Order-Disorder Transformations

19990026677 Department of Energy, Office of Energy Research, Washington, DC USA
Indentation modulus and yield point of Au(111), (001), and (110)
Kiely, J. D., Department of Energy, USA; Houston, J. E., Department of Energy, USA; Dec. 31, 1997; 6p; In English; Sponsored by Materials Research Society, USA
Report No.(s): DE98-005907; SAND-97-3127C; CONF-980405; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Nanoscale indentation experiments were performed on Au using the Interfacial Force Microscope (IFM) in an indentation mode. The indentation modulus and yield point were measured for three orientations of the Au surface: (111), (110), and (001). The indentation modulus for the (111) surface was found to be 36% greater than for the (001) surface and only 3% higher than the (110) surface. Additionally, the yield point was found to vary between orientations, but the shear stress resolved on (l-brace)111(r-brace) slip planes beneath the indenter on the axis of symmetry was found to be approximately 1.8 GPa for yield points of all three orientations.
NTIS
Gold; Yield Strength; Crystal Dislocations; Shear Stress; Yield Point

19990026678 Department of Energy, Office of Energy Research, Washington, DC USA

Electric field effects on the nanometer-level surface modification of Au(111) surfaces

Cabibil, H., Department of Energy, USA; Houston, J. E., Department of Energy, USA; Mayer, T. M., Department of Energy, USA; Franklin, G. F., Department of Energy, USA; Dec. 31, 1998; 6p; In English; Sponsored by Materials Research Society, USA

Report No.(s): DE98-005905; SAND-98-1390C; CONF-980405; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors report observations of contrasting surface modification behavior of the Au(111) in the presence of an electric field and field-emission currents using interfacial force microscopy (IFM) and scanning tunneling microscopy (STM). The experiments consist of surface modification procedures which allow for large tip-sample gaps, in contrast to fast voltage pulses (applied at tunneling distances) employed by previous STM investigations. Dramatic surface distortions are observed when a 200 nm tip, biased at (minus) 100 V, is brought toward the Au surface to a field emission current level of 400 nA and then retracted. In other experiments, the authors raise the sample voltage to field-emission levels while maintaining a constant current. STM images, measured in a time-resolved manner after each such procedure, show that the presence of a higher electric field ((approximately) 0.07 V/A) results in step retraction and the disappearance of small islands on the Au(111) surface followed by the formation of vacancy islands in the area directly beneath the apex of the tip where the field is highest. They discuss the implications of these contrasting surface modification in terms of the various key parameters and in relation to previous studies using voltage pulses in the STM. NTIS

Gold; Surface Properties; Electric Fields; Surface Distortion; Field Emission; Metal Films

19990026683 Department of Energy, Washington, DC USA

Triple ion-beam studies of radiation damage effects in a 316LN austenitic alloy for a high power spallation neutron source

Lee, E. H., Department of Energy, USA; Rao, G. R., Department of Energy, USA; Hunn, J. D., Department of Energy, USA; Rice, P. M., Department of Energy, USA; Lewis, M. B., Department of Energy, USA; Sep. 30, 1997; 11p; In English; 126th; Sponsored by Minerals, Metals and Materials Society, USA

Report No.(s): DE97-009367; CONF-970201-31; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Austenitic 316LN alloy was ion-irradiated using the unique Triple Ion Beam Facility (TIF) at ORNL to investigate radiation damage effects relevant to spallation neutron sources. The TIF was used to simulate significant features of GeV proton irradiation effects in spallation neutron source target materials by producing displacement damage while simultaneously injecting helium and hydrogen at appropriately high gas/dpa ratios. Irradiations were carried out at 80, 200, and 350 C using 3.5 MeV Fe(++), 360 keV He(+), and 180 keV H(+) to accumulate 50 dpa by Fe, 10,000 appm of He, and 50,000 appm of H. Irradiations were also carried out at 200 C in single and dual ion beam modes. The specific ion energies were chosen to maximize the damage and the gas accumulation at a depth of approximately 1 (micro)m. Variations in microstructure and hardness of irradiated specimens were studied using transmission electron microscopy (TEM) and a nanoindentation technique, respectively. TEM investigation yielded varying damage defect microstructures, comprising black dots, faulted and unfaulted loops, and a high number density of fine bubbles (typically less than 1 nm in diameter). With increasing temperature, faulted loops had a tendency to unfault, and bubble microstructure changed from a bimodal size distribution to a unimodal distribution. Triple ion irradiations at the three temperatures resulted in similar increases in hardness of approximately a factor of two. Individually, Fe and He ions resulted in a similar magnitude of hardness increase, whereas H ions showed only a very small effect. The present study has yielded microstructural information relevant to spallation neutron source conditions and indicates that the most important concern may be radiation induced hardening and associated ductility loss. NTIS

Ion Beams; Radiation Damage; Spallation; Neutron Sources; Proton Irradiation; Austenitic Stainless Steels

27
NONMETALLIC MATERIALS

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

19990025209 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China

Effect of Oil Composition on Physical Properties and Spread Width of Polyester Multifilament for Spinning a Composite Yarn

Su, Ching-Iuan, National Taiwan Univ. of Science and Technology, Taiwan, Province of China; Lee, Jiunn-Yih, National Taiwan Univ. of Science and Technology, Taiwan, Province of China; Wu, Wen-Yean, Far Eastern Textile Ltd., Taiwan, Province of China;

Journal of the Chinese Institute of Engineers: Transactions of the Chinese Institute of Engineers, Series A; January 1998; ISSN 0253-3839; Volume 21, No. 1, pp. 81-86; In English; Sponsored in part by China Textile Inst.; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This study examines the effect of oil composition (including the anti-static agent-alkyl ether sulfate) on the physical properties and spread width of polyester multifilament for spinning a composite yarn. The results show that the solid content and viscosity of a special oil are slightly lower than normal oil, which reduces the stickiness of the spreading multifilament. Also, the coefficient of kinetic friction mu(sub k) and electrical conductivity of oiled polyester multifilaments are higher than normal oil in order to conduct and store charges, and to divide easily and spread widely to maintain good spreading performance. The content of the anti-static agent is the most important component of a special oil. For example, the amount of alkyl ether sulfate (RO(CH2CH2O)(n)SO3Na) should be 14% to reduce electrical resistance, and increase spreading performance. Furthermore, the number n of oxyethylene groups(CH2CH20) on alkyl ether sulfate is 2 or 3 in order to maintain a lower electrical resistance and wider spread width.

Author

Polyesters; Filaments; Oils; Alkyl Compounds; Composite Materials; Yarns; Spreading

19990025217 Uniax Corp., Santa Barbara, CA USA

Materials for the "Plastic Retina": Network Blends for Arrays of Polymer Grid Triodes ***Final Report, 9 Aug. 1996 - 9 Aug. 1998***

McElvain, Jon S.; Jan. 1999; 15p; In English

Contract(s)/Grant(s): F49620-96-C-0041

Report No.(s): AD-A359238; ORTD4; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We fabricated one-dimensional Plastic Retina structures by depositing gold strips onto glass substrates, and subsequently applying thin layers of conducting materials onto this pattern The materials that were studied consisted of both conducting polymers (which were spin cast) and inorganic semiconductors In all cases the thin film structures yielded results that were in accordance with theoretical predictions. The test structures were used to quantify the material sheet resistance uniformity and long term stability. Additionally, we have synthesized several varieties of conducting polymer systems, including new PANI derivatives and blends. The ultimate goal of this effort was to create conducting polymer systems that have lower conductivity and higher film uniformity This class of materials is essential to the operation of the Plastic Retina structures (currently being fabricated by UNIAX under a joint BMDO!DARPA program). For the Plastic Retina, or the Thin Film Analog Image Processor (TAIP), a sheet resistance greater than 105(+) Omega/square is required. Furthermore, the TAIP requires a highly uniform (5%) PANI thickness across the surface of the chip. UNIAX has achieved this goal, and successfully fabricated new polymer systems that provide lower conductivities with high film uniformity.

DTIC

Plastics; Grids; Semiconductors (Materials); Conducting Polymers; Retina; Triodes

19990025273 Uniax Corp., Santa Barbara, CA USA

Materials for the Plastic Retina: Network Blends for Arrays of Polymer Grid Triodes ***Final Report, 9 Aug. 1996 - 9 Aug. 1998***

McElvain, Jon S.; Jan. 19, 1999; 15p; In English

Contract(s)/Grant(s): F49620-96-C-0041; AF Proj. 2303

Report No.(s): AD-A359232; ORTD4; AFRL-SR-BL-TR-99-0013; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We fabricated one-dimensional Plastic Retina structures by depositing gold strips onto glass substrates, and subsequently applying thin layers of conducting materials onto this pattern. The materials that were studied consisted of both conducting polymers (which were spin cast) and inorganic semiconductors. In all cases the thin film structures yielded results that were in accordance with theoretical predictions. The test structures were used to quantify the material sheet resistance uniformity and long-term stability. Additionally, we have synthesized several varieties of conducting polymer systems, including new PANI derivatives and Mends. The ultimate goal of this effort was to create conducting polymer systems that have lower conductivity and higher film uniformity. This class of materials is essential to the operation of the Plastic Retina structures (currently being fabricated by UNIAX under a joint BMDO/DARPA program). For the Plastic Retina, or the Thin Film Analog Image Processor (TAIP), a sheet resistance greater than 10(exp 5) omega/square is required. Furthermore, the TAIP requires a highly uniform (5%) PANI thickness

across the surface of the chip. UNIAX has achieved this goal, and successfully fabricated new polymer systems that provide lower conductivities with high film uniformity.
DTIC
Conducting Polymers; Semiconductors (Materials); Retina; Triodes

19990025279 University of Southern California, Dept. of Electrical Engineering, Los Angeles, CA USA
Instrumentation Facility for the Evaluation, Testing, and Packaging of Polymer Materials and Devices for Integrated Optical Circuits and Photonic Systems ***Final Report, 1 Apr. 1997 - 31 Mar. 1998***
Steier, William; Dec. 31, 1998; 7p; In English
Contract(s)/Grant(s): F49620-97-0216; AF Proj. 3484
Report No.(s): AD-A359204; AFRL-SR-BL-TR-99-0001; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This report describes the instrumentation facilities now available for the evaluation of new polymer materials for photonics and the measurement of polymer photonic devices. This new instrumentation was purchased and constructed using the funds from this DURIP Grant. The new facilities include attenuated total reflection and ellipsometric instrumentation for the measurement of electro-optic coefficients. Instrumentation for the measurement of thin film waveguide loss and material index of refraction by spectroscopic ellipsometry are also available. The high speed characterization of polymer devices using pico-second pulses at a wavelength of 1550 nm are now possible with this instrumentation.
DTIC
Electro-Optics; Photonics; Integrated Circuits; Instruments

19990025372 NASA Lewis Research Center, Cleveland, OH USA
Surface Design and Engineering Toward Wear-Resistant, Self-Lubricating Diamond Films and Coatings
Miyoshi, Kazuhisa, NASA Lewis Research Center, USA; February 1999; 14p; In English; 128th, 28 Feb. - 4 Mar. 1999, San Diego, CA, USA; Sponsored by Minerals, Metals and Materials Society, USA
Contract(s)/Grant(s): RTOP 523-22-13
Report No.(s): NASA/TM-1999-208905; E-11425; NAS 1.15:208905; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The tribological properties of chemical-vapor-deposited (CVD) diamond films vary with the environment, possessing a Jekyll-and-Hyde character. CVD diamond has low coefficient of friction and high wear resistance in air but high coefficient of friction and low wear resistance in vacuum. Improving the tribological functionality of materials (such as achieving low friction and good wear resistance) was an aim of this investigation. Three studies on the surface design, surface engineering, and tribology of CVD diamond have shown that its friction and wear are significantly reduced in ultrahigh vacuum. The main criteria for judging whether diamond films are an effective wear-resistant, self-lubricating material were coefficient of friction and wear rate, which must be less than 0.1 and on the order of 10(exp 6) cu mm/N(dot)m, respectively. In the first study the presence of a thin film (less than 1 micron thick) of amorphous, nondiamond carbon (hydrogenated carbon, also called diamondlike carbon or DLC) on CVD diamond greatly decreased the coefficient of friction and the wear rate. Therefore, a thin DLC film on CVD diamond can be an effective wear-resistant, lubricating coating in ultrahigh vacuum. In the second study the presence of an amorphous, nondiamond carbon surface layer formed on CVD diamond by ion implantation significantly reduced the coefficient of friction and the wear rate in ultrahigh vacuum. Therefore, such surface layers are acceptable for effective self-lubricating, wear-resistant applications of CVD diamond. In the third study CVD diamond in contact with cubic boron nitride exhibited low coefficient of friction in ultra high vacuum. Therefore, this materials combination can provide an effective self-lubricating, wear-resistant couple in ultrahigh vacuum.
Author
Coating; Self Lubricating Materials; Diamond Films; Surface Layers; Wear Resistance; Boron Nitrides; Coefficient of Friction; Thin Films; Vapor Deposition

19990025376 TechDrive, Inc., Oak Brook, IL USA
Solid Polymer Electrolytes Derived from Polyphenols ***Final Report, 28 Apr. - 27 Oct. 1998***
Filler, Robert, TechDrive, Inc., USA; Nov. 09, 1998; 15p; In English
Contract(s)/Grant(s): DAAN02-98-P-8457
Report No.(s): AD-A358865; TDI/ARMY-NATICK/I/98; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In the Phase I study, Tech Drive synthesized several phenol monomers. Two of these monomers, one of which is new, were converted to phenolic polymers by enzymatic means, using horseradish peroxidase and hydrogen peroxide. The monomers and polymers were fully characterize using thin layer chromatography, FT-IR and NMR spectroscopy, gel permeation

chromatography and light scattering analyses. Solid polymeric electrolytes (SPEs) were formulated using the processable polyphenols. Ionic conductivity measurements of one of the SPEs based on a substituted polyphenol showed promising levels of ionic conductivity. Addition of a plasticizer dramatically improved the room temperature conductivity of the SPE film. Laboratory cells, fabricated using the SPEs, gave very promising results.
DTIC
Solid Electrolytes; Polymers; Electric Conductors; Ion Currents

19990025496 California Univ., Dept. of Electrical and Computer Engineering, Davis, CA USA
Characterization of Nonlinear Polymers for High-speed Photonic Response and Nonlinear Dispersion ***Final Report, 1 Apr. 1997 - 31 Mar. 1998***
Knoesen, Andre; Mar. 1998; 2p; In English
Contract(s)/Grant(s): F49620-97-1-0284; AF Proj. 3484
Report No.(s): AD-A359182; AFRL-SR-BL-TR-98-0864; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
High-frequency instrumentation was acquired to perform: (a) high-frequency dielectric measurements on poled electro-active polymers and to determine the stability when exposed to microwave radiation, and (b) electro-optic measurements of the resonant enhancement of nonlinear polymers with demonstrated photochemical stability. In particular, the equipment was used to investigate large-bandwidth, traveling wave polymeric in-line fiber (PILF) modulator that is being co-developed by UC Davis and Optivision. This PILF amplitude modulator consists of a fiber half-coupler substrate evanescently coupled to a multimode electro-optic waveguide. PILF modulators are intrinsically rugged, exhibit low third order intermodulation nonlinearity and can be produced at lower cost than fiber pigtailed modulators. The equipment consisted of a high-frequency probe station, high-frequency amplifier and signal generator, 15 GHz photodetector, low relative intensity noise fiber coupled 1330 nm laser, and a 1064 diode pumped laser. The deviations from the original budget are that the $30K in UC cost sharing was used towards a laser ablation accessory for the probe station (instead of the thermal evaporator), the elimination of the 1550 nm laser source and the purchase with fund remaining a high-frequency signal generator.
DTIC
Nonlinearity; High Speed; Photochemical Reactions; Semiconductor Lasers; Electro-Optics; High Frequencies; Instruments

19990025565 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Inst. of Materials Research, Cologne, Germany
Mullite and Mullite Ceramics
Jan. 1994; 42p; In English
Contract(s)/Grant(s): F61708-94-W-0696
Report No.(s): AD-A359090; EOARD-CSP-94-1021; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The Final Proceedings for Mullite and Mullite Ceramics, 7 September 1994 - 9 September 1994.
DTIC
Conferences; Composite Materials

19990025639 Rennes Univ., Centre d'Etudes des Problemes De La Mer, France
Nonlinear Optical Properties of Tex-Derived Glasses ***Final Report***
Lucas, Jacques, Rennes Univ., France; Jan. 1996; 25p; In English
Report No.(s): AD-A358908; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This report results from a contract tasking University of Rennes as follows: The main target of this study was to prepare several new compositions of infra-red glasses, to characterize them with respect to their stability versus crystallization and thermal behavior. These new glasses prepared in a bulk disk shapes have then been investigated by optical measurements in the region of the band gap absorption.
DTIC
Glass; Infrared Radiation; Optical Properties; Nonlinear Systems; Infrared Filters

19990025659 Swales Aerospace, Beltsville, MD USA
Tailoring Thin Film-Lacquer Coatings for Space Applications
Peters, Wanda C., Swales Aerospace, USA; Harris, George, Swales Aerospace, USA; Miller, Grace, Swales Aerospace, USA; Petro, John, Swales Aerospace, USA; 1998; 12p; In English; 44th, 23-27 May 1999, Long Beach, CA, USA; Sponsored by Society for Advancement of Materials and Process Engineering, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Thin film coatings have the capability of obtaining a wide range of thermal radiative properties, but the development of thin film coatings can sometimes be difficult and costly when trying to achieve highly specular surfaces. Given any space mission's then-nal control requirements, there is often a need for a variation of solar absorptance (alpha(sub s)), emittance (epsilon) and/or highly specular surfaces. The utilization of thin film coatings is one process of choice for meeting challenging thermal control requirements because of its ability to provide a wide variety of alpha(sub s)/epsilon ratios. Thin film coatings' radiative properties can be tailored to meet specific thermal control requirements through the use of different metals and the variation of dielectric layer thickness. Surface coatings can be spectrally selective to enhance radiative coupling and decoupling. The application of lacquer to a surface can also provide suitable specularity for thin film application without the cost and difficulty associated with polishing.
Author
Thermodynamic Properties; Thickness; Thin Films; Space Missions; Solar Energy Absorbers; Lacquers; Dielectrics; Decoupling

19990025755 Defence Research Establishment Atlantic, Dartmouth, Nova Scotia Canada
Evaluation of the Chemical Resistance of Epichlorohydrin and Fluorocarbon Elastomers to Hydrocarbon Fill Fluids
Hiltz, John A.; Keough, Irvin A.; Sep. 1998; 30p; In English
Report No.(s): AD-A359043; DREA-TM-98/229; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The chemical resistance of an epichlorohydrin elastomer and three fluorocarbon elastomers to Bayol 35, Voltesso 35, and Marcol 72 hydrocarbon fill fluids has been investigated. Absorption of fill fluid and the resulting change in the glass transition temperature were used to evaluate the chemical resistance of the elastomers. The weight change of the fluorocarbon elastomers was less than 0.1% by weight indicating that these elastomers have excellent chemical resistance to the fluids. The epichlorohydrin elastomer absorbed approximately 0.6% Bayol 35, 2.0% Voltesso 35, and 3.25% Marcol 72 and the Tg of the epichlorohydrin elastomer decreased slightly following immersion in the fill fluids. This elastomer has good to excellent resistance to the fill fluids. The Tg of the four elastomers studied here are high enough to cause concern about these elastomers undergoing a rubber to glass transition in low temperature, high frequency applications. Epichlorohydrin based copolymer or terpolymer elastomers have lower Tgs and should remain rubbery at low temperature and higher frequencies. Evaluation of these elastomers is warranted.
DTIC
Copolymers; Elastomers; Fluorocarbons; Glass Transition Temperature

19990025783 Department of Energy, Assistant Secretary for Fossil Energy, Washington, DC USA
Task 6.3 -- Engineering performance of advanced structural materials ***Semiannual Report, Jan. 1 - Jun. 30 1995***
Hurley, J. P., Department of Energy, USA; Kay, J., Department of Energy, USA; Nowok, J. W., Department of Energy, USA; Schuster, M., Department of Energy, USA; Aug. 31, 1997; 12p; In English
Report No.(s): DE97-002255; DOE/MC/30097-5608; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

SiC sublimes without melting at temperatures over 2,000 C. This makes SiC difficult to use in the fabrication of large structures, because pieces made from SiC cannot be joined together in the same way that metals can be welded. Therefore, the size of the monolithic ceramic structures that can be manufactured are limited by the size of the sintering furnaces (approximately 10 feet for sintered alpha silicon carbide). In order to make larger objects such as heat exchangers, many small ceramic pieces must be fused or joined. In addition, repair of the objects will require the use of field joining techniques. At present, no joining techniques for high-temperature structural ceramics are routinely available. The objective of this work at the Energy and Environmental Research Center (EERC) is to develop a patentable technique for joining large silicon based advanced ceramics in the field. The key to developing a successful technique will be the use of reactive joining compounds to lower the joining temperature but without leaving continuous channels of unreacted compounds that can weaken the joint or be conduits for corrosion at temperatures over 1,400 C. Special efforts will be made in this project to transfer the developed technologies to the materials industry via licensing agreements through the EERC Foundation.
NTIS
Energy Technology; Ceramics; Construction Materials

19990025883 Cape Code Research, Inc., East Falmouth, MA USA
Methods for Reducing Volatile Organic Content in Fabric Waterproof Coatings ***Final Report, May - Nov. 1993***
Keohan, Francis L.; Lazaro, Edgar; Mar. 1994; 48p; In English
Contract(s)/Grant(s): DAAK60-93-C-0037
Report No.(s): AD-A359280; NATICK-TR-94-0; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Fabrics for rainwear and outdoor equipment traditionally have been rendered waterproof by coating with solventborne rubber solutions, solventborne polyurethanes and vinyl plastisols. Regulatory pressure for environmental protection and worker safety has become a potent driving force in eliminating volatile organic solvents and toxic additives from commercial coating products. A variety of low-solvent coating technologies are being introduced to replace the traditional solvent-based products. These include high solids formulation, solventless UV and electron beam curing systems, powder coatings and supercritical, CO2 -reduced paints. The benefits and limitations of these coating technologies were compared with respect to their applicability to fabric waterproofing. In addition, a novel acrylated surfactant was synthesized and employed in the formulation of UV-curing waterborne coatings for textile waterproofing. The application methods and cure characteristics of the solvent-free formulations are described. Physical properties of cured coating films including tensile strength, percent elongation, water absorption, water drop contact angle, and adhesion to common fabrics were measured and compared to those obtained using a commercial waterborne waterproofing system. One formulation produced cured films having low water absorption, tenacious adhesion to polyester fabric and surface hydrophobicity properties approaching those of polyethylene.
DTIC
Environment Protection; Polyethylenes; Polyurethane Resins; Carbon Dioxide; Adhesion

19990025885 Institut fuer Werkstoff-Forschung, Cologne, Germany
Journal of the European Ceramic Society, Volume 16
Jan. 1996; ISSN 0955-2219; 215p; In English; Mullite and Mullite Ceramics, 7-9 Sep. 1994, Irsee, Germany
Contract(s)/Grant(s): F617089-94-W-0696
Report No.(s): AD-A359326; EOARD-CSP-94-1021-Vol-16-No-2; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche
The Final Proceedings for Mullite and Mullite Ceramics, 7 September 1994 - 9 September 1994
DTIC
Ceramics; Mullites; Documents

19990025909 Department of Energy, Washington, DC USA
Application of integral equation theory to polyolefin liquids and blends
Curro, J. G., Department of Energy, USA; Weinhold, J. D., Department of Energy, USA; Nov. 30, 1997; 4p; In English; Sponsored by American Chemical Society, USA
Report No.(s): DE98-001384; SAND-97-2905C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The ability to model the packing of polymers in melts and blends is important in many polymer applications. One significant application is the development of new polymer blends. It would be exceedingly helpful to the materials chemist if molecular modeling could be employed to predict the thermodynamics and phase behavior of hypothetical polymer alloys before embarking on a time consuming and expensive synthesis program. The well known Flory-Huggins theory has been remarkably successful in describing many aspects of polymer mixing from a qualitative point of view. This theory is known, however, to suffer from several deficiencies which can be traceable to the fact that: (1) it is a lattice model requiring both monomer components to have the same volume; and (2) a mean field or random mixing approximation is made which effectively ignores chain connectivity. Because of these limitations the Flory-Huggins theory does not include packing effects and cannot be used to make quantitative molecular engineering calculations. Recently Curro and Schweizer developed a new approach for treating polymer liquids and mixtures which the authors call PRISM theory. This is an extension to polymers of the Reference Interaction Site Model (RISM Theory) developed by Chandler and Andersen to describe the statistical mechanics of small molecule liquids. The PRISM theory is a continuous space description of a polymer liquid, which includes chain connectivity and nonrandom mixing effects in a computationally tractable manner. The primary output from PRISM calculations is the average structure or packing of the amorphous liquid given by the radial distribution function denoted as g(r). This radial distribution function is employed to deduce thermodynamic or structural properties of interest. Here, the authors describe the theoretical approach and demonstrate its application to polyethylene, isotactic polypropylene, syndiotactic polypropylene, and polyisobutylene liquids and blends.
NTIS
Integral Equations; Polymer Blends

19990025921 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
The Properties of Dendritic Polymers 2: Generation Dependence of the Physical Properties of Poly(amidoamine) Dendrimers *Final Report*
Uppuluri, Srinivas; Dvornic, Petar R.; Beck Tan, Nora C.; Hagnauer, Gary; Jan. 1999; 39p; In English
Report No.(s): AD-A359423; ARL-TR-1774; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Dendritic polymers, or dendrimers, represent a new class of macromolecules characterized by an ultra-branched molecular architecture generated by a novel synthetic route developed in the mid-1980s. As the synthetic science of these molecules matures, the search for applications of them is becoming increasingly active. However, a lack of physical property data has made the identification of suitable application and technology areas that are ripe for exploitation of dendrimers difficult. The purpose of this series of reports is to compile, in the most concise form possible, some fundamental physical property information about dendrimers. The focus is on the behavior of poly(amidomine) or PAMAM dendrimers, which were developed in the USA and are produced domestically by Dendritech, Inc., of Midland, Michigan. In this report, the second in our series, the effect of molecular size or ”generation” of the dendritic polymers on their physical properties is highlighted. The first report, ARL-TR-1606 was published in May 1998 and was focused on the general physical behavior of a mid-sized (Generation 5) PAMAM dendrimer. The third report, slated for completion in early 1999, will focus on ”end group” chemistry dependence of PAMAM dendrimers.
DTIC
Polymers; Synthesis; Macromolecules

19990025931 Army Construction Engineering Research Lab., Champaign, IL USA
Shear Strengthening of Reinforced Concrete Beams Using Fiber-Reinforced Polymer Wraps ***Final Report***
Brady, Pamalee A.; Marshall, Orange S.; Oct. 1998; 80p; In English
Report No.(s): AD-A359462; CERL-SR-99/01; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Studies have shown that fiber-reinforced polymer (FRP) wraps can improve the capacity of rectangular beam sections. This technology has potential application to highway bridges that may have less shear capacity than flexural capacity or require added load capacity to handle current traffic demands. Compared with steel repair materials FRP offers several benefits, such as corrosion resistance and field-workability. Several studies have investigated the use of externally bonded FRP sheets to improve strength and stiffness of reinforced concrete (R/C) beams, but most have addressed flexural strength, not shear. The objective of the current study was to test the effectiveness of FRP wraps in repairing full-scale prestressed high-strength concrete joists fabricated with insufficient shear reinforcement. Four prestressed high-strength concrete tee-beams (joists) with integral web openings were tested. Two of the joists were repaired or upgraded with FRP wraps to improve shear performance and two were used as control specimens. Performance criteria were specified, and standard structural engineering practice for shear design was employed to determine wrap thickness. The results of the tests indicate that significant increases in the shear strength of R/C beams with insufficient shear capacity can be achieved by proper application of FRP wraps.
DTIC
Beams (Supports); Structural Engineering; Shear Strength; Fiber Composites; Concretes

19990026067 Department of Energy, Washington, DC USA
Massively Parallel Simulations of Diffusion in Dense Polymeric Structures
Faulon, J. L. W. R., Department of Energy, USA; Nov. 30, 1997; 20p; In English; Supercomputing 1997: High Performance Networking and Computing, Unknown
Report No.(s): DE98-000615; SAND-97-2692C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

An original computational technique to generate close-to-equilibrium dense polymeric structures is proposed. Diffusion of small gases are studied on the equilibrated structures using massively parallel molecular dynamics simulations running on the Intel Teraflops (9216 Pentium Pro processors) and Intel Paragon(1840 processors). Compared to the current state-of-the-art equilibration methods this new technique appears to be faster by some orders of magnitude. The main advantage of the technique is that one can circumvent the bottlenecks in configuration space that inhibit relaxation in molecular dynamics simulations. The technique is based on the fact that tetravalent atoms (such as carbon and silicon) fit in the center of a regular tetrahedron and that regular tetrahedrons can be used to mesh the three-dimensional space. Thus, the problem of polymer equilibration described by continuous equations in molecular dynamics is reduced to a discrete problem where solutions are approximated by simple algorithms. Practical modeling applications include the constructing of butyl rubber and ethylene-propylene-dimer-monomer (EPDM) models for oxygen and water diffusion calculations. Butyl and EPDM are used in O-ring systems and serve as sealing joints in many manufactured objects. Diffusion coefficients of small gases have been measured experimentally on both polymeric systems, and in general the diffusion coefficients in EPDM are an order of magnitude larger than in butyl. In order to better understand the diffusion phenomena, 10,000 atoms models were generated and equilibrated for butyl and EPDM. The models were submitted to a massively parallel molecular dynamics simulation to monitor the trajectories of the diffusing species.
NTIS
Massively Parallel Processors; Gaseous Diffusion; Computerized Simulation; Parallel Processing (Computers); Molecular Dynamics; Dimers; Monomers

19990026131 Department of Energy, Office of Energy Research, Washington, DC USA

Practical limitations to indentation testing of thin films

Schneider, J. A., Department of Energy, USA; McCarty, K. F., Department of Energy, USA; Heffelfinger, J. R., Department of Energy, USA; Moody, N. R., Department of Energy, USA; Dec. 31, 1998; 5p; In English; Materials Research Society

Report No.(s): DE98-052516; SAND-98-8459C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A method that is becoming increasingly common for measuring the mechanical behavior of thin films is low-load indentation testing. However, there can be complications in interpreting the results as many factors can affect hardness and moduli measurements such as surface roughness and determination of the indentation contact area. to further the understanding, the mechanical properties of thin 50 nm films of AlN on sapphire substrates were evaluated using a scanning force microscopy (SFM) based pico-indentation device to allow imaging of the surface and indentations. The primary emphasis was the types of problems or limitations involved in testing very thin, as deposited films in which properties are desired over indentation depths less than 50 nm.

NTIS

Thin Films; Load Tests

19990026148 Department of Energy, Office of Energy Research, Washington, DC USA

Oxidation behavior of SiC sintered with Al-B-C and improved oxidation resistance via heat treatments

Sixta, M., Department of Energy, USA; Dec. 31, 1997; 99p; In English

Report No.(s): DE98-057486; LBNL-41464; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The oxidation behavior of high strength and high toughness SiC, sintered with Al, B, and C (ABC-SiC), was examined. Kinetic data were acquired and the parabolic rate constant for oxidation was determined and compared with literature data on various SiC materials. The role of secondary phases on the oxide morphology was explored. ABC-SiC was compared to commercially available SiC, Hexoloy, and SiC sintered with 10% yttrium aluminum garnet (YAG). Two-step sintering (pre-coarsening) was employed with holds for 48 hours at 600--1,600 C, prior to the typical hot-pressing conditions of 1,900 C for 1 hour, to change the chemistry and reduce the number of bubbles in the silica scale. The effects on the oxide thickness and integrity was examined as a function of the precoarsening heat treatment temperature. Additionally, the hot-pressed ABC-SiC was subjected to heat treatments (anneals) at 1,800 C for 1 hour in nitrogen, Ar, and vacuum environments, and the effects on subsequent oxidation were evaluated. The Ar and vacuum heat treatments dramatically improved the oxidation resistance of ABC-SiC. Finally, reoxidation experiments were performed to try to alter the surface chemistry of the SiC to improve the oxidation resistance. The four-point bend strengths and two-parameter Weibull plots of the most successful heat treatments were compared with the standard ABC-SiC to ensure that significant degradation did not result from altering the processing of the material.

NTIS

Oxidation; Oxidation Resistance; Silicon Carbides; Annealing; Additives

19990026202 Institute of Industrial Technology TNO, Dept. of Surface Technology, Helder, Netherlands

Corrosion Protection with Thermally Sprayed Ceramic Coatings *Final Report Corrosiebescherming met Thermische Gespoten Keramische Deklagen*

Vreijling, M. P.W., Institute of Industrial Technology TNO, Netherlands; Suurmond, A., Institute of Industrial Technology TNO, Netherlands; Oct. 19, 1998; In Dutch; Original contains color illustrations

Contract(s)/Grant(s): A96/KM/113

Report No.(s): TD98-0369; CA/98.9028; Copyright; Avail: Issuing Activity (TNO Inst. of Industrial Technology, Dept. of Surface Technology, Ambachtsweg 8A, Postbus 57, 1780 AB Den Helder), Hardcopy, Microfiche

The purpose of this research is to show that thermally sprayed ceramic coatings can be used to provide adequate corrosion protection in seawater. To this purpose, two types of ceramic top coatings with metallic primer layers were evaluated based on polarisation behaviour, potential monitoring and visual characterisation. The results indicate that these systems can be used to provide acceptable corrosion protection in seawater. The electrochemical behaviour of a thermally sprayed coating system consisting of a metallic primer layer and a ceramic top-coating is determined by the metallic primer layer. Therefore electrochemical measurements do not directly address the condition of the top-coating. However, in a practical situation the metallic primer will heavily erode when the top-coating is of poor quality. So ultimately electrochemical measurements remain valid for the monitoring of the integrity of the corrosion protection system.

Author

Sprayed Coatings; Corrosion Prevention; Ceramic Coatings; Research; Evaluation

19990026264 Department of Energy, Washington, DC USA

Understanding and control of optical performance from ceramic materials

Barbour, J. C., Department of Energy, USA; Knapp, J. A., Department of Energy, USA; Potter, B. G., Department of Energy, USA; Jennison, D. R., Department of Energy, USA; Verdozzi, C. A., Department of Energy, USA; Jun. 30, 1998; 23p; In English

Report No.(s): DE98-002962; SAND-98-1210; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This report summarizes a two-year Laboratory-Directed Research and Development (LDRD) program to gain understanding and control of the important parameters which govern the optical performance of rare-earth (RE) doped ceramics. This LDRD developed the capability to determine stable atomic arrangements in RE doped alumina using local density functional theory, and to model the luminescence from RE-doped alumina using molecular dynamic simulations combined with crystal-field calculations. Local structural features for different phases of alumina were examined experimentally by comparing their photoluminescence spectra and the atomic arrangement of the amorphous phase was determined to be similar to that of the gamma phase. The luminescence lifetimes were correlated to these differences in the local structure. The design of both high and low-phonon energy host materials was demonstrated through the growth of Er-doped aluminum oxide and lanthanum oxide. Multicomponent structures of rare earth doped telluride glass in an alumina and silica matrix were also prepared. Finally, the optical performance of Er-doped alumina was determined as a function of hydrogen content in the host matrix. This LDRD is the groundwork for future experimentation to understand the effects of ionizing radiation on the optical properties of RE-doped ceramic materials used in space and other radiation environments.

NTIS

Optical Properties; Optical Materials; Ceramics; Rare Earth Elements; Research and Development; Doped Crystals

19990026437 Technology Assessment and Transfer, Inc., Annapolis, MD USA

Ion Beam Deposited Metal Oxide and Fluoride Composite Coatings for High Temperature Tribological Applications ***Final Report, 1 Sep. 1997 - 31 Aug. 1998***

Fehrenbacher, Larry L.; Arps, James H.; Dec. 1998; 23p; In English

Contract(s)/Grant(s): F49620-97-C-0056; AF Proj. STTR

Report No.(s): AD-A359986; AFRL-SR-BL-TR-99-0037; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Wide temperature, solid lubricant films offer payoffs for military turbomachinery components: rub seals, face seals, fretting interfaces and bearings. Multilayer films of B4C/Mo, B4C/Cr, Zn/W, Ni/Ti, Au/Cr, W/MoS and AlCuFeCr films were deposited by planar magnetron sputtering or ion bombardment assisted deposition (IBAD), and evaluated for adhesion, friction and wear properties from room temperature to as high as 1100 deg F. Oxidized Zn/W and W/MoS2 films exhibited low friction coefficients at room temperature. However, only AlFeCuCr quasicrystalline films consistently produced low friction coefficients at high temperature, suggesting that these films warrant further investigation. High friction coefficients obtained with IBAD Ni-Ti films at 1100 deg F were especially puzzling given previous Southwest Research Institute results that showed low friction values at high temperature.

DTIC

Protective Coatings; Solid Lubricants; Wear Resistance; Ion Beams; Magnetron Sputtering; Metal Oxides; Tribology; Composite Materials; Fluorides

19990026442 California Univ., Coll. of Engineering, Santa Barbara, CA USA

Oxidation-Induced Failure of Thermal Barrier Coatings ***Annual Report, 1 Oct. 1997 - 31 Oct. 1998***

Clarke, David R.; Dec. 1998; 71p; In English

Contract(s)/Grant(s): N00014-97-1-0190

Report No.(s): AD-A360036; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

On prolonged high-temperature exposure in air, thermal barrier coatings (TBCs) on bond-coated superalloys fail by spalling. We have focused on identifying the underlying mechanisms of failure and sought to establish whether it is a direct consequence of the failure of the underlying thermally grown oxide. We have discovered a new TBC failure mode, one in which failure is associated with moisture-enhanced sub-critical crack-growth along the bond-coat/thermally grown oxide interface. by making concurrent piezospectroscopy measurements, the interfacial fracture energy was determined to be 10 J/sq m - a considerably smaller value than that of sapphire/metal interfaces prepared in the laboratory but consistent with measurements of the effects of segregation on metal/ceramic interfaces. New insights into the mechanism underlying failure of the thermally grown oxide have come from direct optical microscopy. These indicate that failure is associated with surface roughness of the bond-coat and specifically that the thermally-grown oxide separates from the bond-coat on cooling at the concave (”crests”) surface features. These locally

separated regions grow with oxidation time and are seen to link-up. These events are believed to be the precursor events that grow to provide the critical-sized flaws from which buckling and spalling of thermal barrier coatings occur.
DTIC
Thermal Control Coatings; Oxidation; Ceramics; Thermal Insulation; Failure; Fracturing; Heat Resistant Alloys

19990026461 Department of the Navy, Washington, DC USA
Scandia, Yttria-Stabilized Zirconia for Ultra-High Temperature Thermal Barrier Coatings
Jones, Robert L., Inventor; Jul. 14, 1998; 11p; In English; Supersedes US-Patent-Appl-SN-741006
Patent Info.: Filed 31 Oct. 96,; US-Patent-Appl-SN-741,006; US-Patent-5,780,178
Report No.(s): AD-D019223; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A composite structure includes a self-supporting substrate and a thermal barrier coating of zirconia stabilized with scandia and yttria. A method of protecting the surface of a self-supporting substrate from degradation caused by exposure to temperatures above 1200 deg C. includes the step of applying to the surface a coating of zirconia stabilized with scandia and yttria.
DTIC
Yttrium Oxides; Scandium; Thermal Insulation; Oxides; High Temperature

19990026467 Department of Energy, Office of Energy Research, Washington, DC USA
Rare earth magnetic order in RNi2B2C and RNiBC
Skanthakumar, S., Department of Energy, USA; Lynn, J. W., Department of Energy, USA; Jul. 05, 1998; 22p; In English; Strongly Correlated Electron Systems, USA
Report No.(s): DE98-057944; ANL/CHM/CP-95915; CONF-980745; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A review of neutron diffraction experiments on the magnetic order in the RNi2B2C and RNiBC (R-rare earth) systems is given. The RNi2B2C materials exhibit a wide variety of commensurate and incommensurate magnetic structures for different rare earths, along with superconductivity that is coupled to the magnetism. Simple commensurate antiferromagnetic structures are observed for R = Pr (T(sub N) = 4.0 K), Nd (T(sub N) = 4.8 K), Ho (T(sub N) = 8.5 K) and Dy (T(sub N) = 4.8 K). In addition, HoNi2B2C exhibits a c-axis spiral and an a-axis modulated incommensurate structure above 5 K, while both structures collapse in favor of the commensurate structure at low T. A transversely polarized spin density wave (SDW) type incommensurate structure is observed for Er (T(sub N) = 6.8 K) and Tm (T(sub N) = 1.5 K), while a longitudinally polarized SDW structure is observed for Tb (T(sub N) = 15 K). No magnetic ordering of any type is detected for Y, Ce and Yb. HoNiBC is an antiferromagnet (T(sub N) = 9.8 K), ErNiBC is a ferromagnetic (T(sub C) = 4.6 K), while TbNiBC and DyNiBC exhibit both ferromagnetic and antiferromagnetic ordering at 17 K and approximately 13 K, respectively.
NTIS
Rare Earth Compounds; Boron Compounds; Nickel Compounds; Carbides

19990026519 Department of the Navy, Washington, DC USA
Deposition of High Quality Diamond Film on Refractory Nitride
Moran, Mark B., Inventor; Johnson, Linda F., Inventor; Klemm, Karl A., Inventor; Sep. 01, 1998; 9p; In English; Supersedes
Patent Info.: Filed 16 May 91,; US-Patent-Appl-SN-702,208
Report No.(s): AD-D019229; PAT-5,800,879; No Copyright; Avail: US Patent and Trademark Office, Microfiche

An adhering, continuous diamond film of optical or semiconductor quality is deposited on a substrate by forming on the substrate a layer of a nitride and then depositing diamond on the nitride without mechanical treatment or seeding of the substrate or the nitride. A substrate of silicon or silicon carbide has been used by depositing a layer of silicon dioxide directly on the substrate and then directly depositing the nitride layer on the silicon dioxide. a polycrystalline diamond film has been deposited by heating the substrate and nitride layer in a vacuum chamber containing a microwave activated mixture of hydrogen and a gas including carbon with the nitride being a refractory nitride to withstand the temperature at which the diamond is deposited. Deposition of the diamond is facilitated by adding oxygen to the mixture after a sufficient thickness of diamond is deposited to protect the nitride layer from oxidation.
DTIC
Diamond Films; Semiconductors (Materials); Nitrides; Refractories; Polycrystals

19990026595 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA

Boron nitride coatings and materials for use in aggressive environments

Besmann, T. M., Department of Energy, USA; Lee, W. Y., Department of Energy, USA; Young, J. P., Department of Energy, USA; Xiao, H., Department of Energy, USA; Dec. 31, 1997; 6p; In English, 1997, USA; Sponsored by Materials Research Society, USA

Report No.(s): DE98-004899; ORNL/CP-96733; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Boron nitride coatings and structures have demonstrated significant resistance to many corrosive environments. These coatings may have application in the protection of sensors needed for measuring a variety of properties such as temperature and chemistry. In addition, boron nitride materials may offer advantages as structural materials in high temperature materials processing. In this study, BN is assessed for use in aluminum smelting.

NTIS

Boron Nitrides; Corrosion Resistance; Coatings; Refractory Materials

19990026627 Department of the Navy, Washington, DC USA

Fluoroaliphatic Cyanate Resins for Low Dielectric Applications

Snow, Arthur W., Inventor; Buckley, Leonard J., Inventor; Sep. 15, 1998; 10p; In English; Supersedes US-Patent-Appl-SN-621149, AD-D017922.

Patent Info.: Filed 21 Mar. 96,; US-Patent-Appl-SN-621,149; US-Patent-5,807,967

Report No.(s): AD-D019192; No Copyright; Avail: US Patent and Trademark Office, Microfiche

The present invention is a cyanate resin monomer having the formula: NCO-CH2-(CF2)n-CH2-OCN, where n is an even integer from 6 to 10, inclusive. Another aspect of the invention is an essentially pure cyanate resin monomer having the formula: NCO-CH2-(CF2)n-CH2-OCN where n=3, 4, 6, 8, or 10. Another aspect of the invention is a prepolymer made by the process of heating a monomer of the invention to a conversion below the gel point. Another aspect of the invention is a method for depositing an interlevel dielectric resin on an integrated circuit, having the steps: (a) coating the integrated circuit with a thin film of a prepolymer made by the process of heating a monomer of the invention to below the gel point, and (b) curing the prepolymer to at least the gel point. Another aspect of the invention is a low dielectric thermoset polymer resin made from these monomers. Another aspect of the invention is a composite of a resin of the invention combined with another material or materials or structural and/or electronic applications. Such materials include powders and fibers made from, e.g., fused silica or quartz. Another aspect of the invention is making and purifying the monomers of the invention.

DTIC

Dielectrics; Cyanates; Integrated Circuits

19990026658 Department of Energy, Office of Energy Research, Washington, DC USA

Electrically insulating films deposited on V-4%Cr-4%Ti by reactive CVD

Park, J. H., Department of Energy, USA; Apr. 30, 1998; 7p; In English; 12th; Surface Modification Technologies, USA

Report No.(s): DE98-057804; ANL/ET/CP-95685; CONF-981023; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In the design of liquid-metal blankets for magnetic fusion reactors, corrosion resistance of structural materials and the magnetohydrodynamic forces and their influence on thermal hydraulics and corrosion are major concerns. Electrically insulating CaO films deposited on V-4%Cr-4%Ti exhibit high-ohmic insulator behavior even though a small amount of vanadium from the alloy become incorporated into the film. However, when vanadium concentration in the film is > 15 wt.%, the film becomes conductive. When the vanadium concentration is high in localized areas, a calcium vanadate phase that exhibits semiconductor behavior can form. The objective of this study is to evaluate electrically insulating films that were deposited on V-4%Cr-4%Ti by a reactive chemical vapor deposition (CVD) method. to this end, CaO and Ca-V-O coatings were produced on vanadium alloys by CVD and by a metallic-vapor process to investigate the electrical resistance of the coatings. The authors found that the Ca-V-O films exhibited insulator behavior when the ratio of calcium concentration to vanadium concentration R in the film > 0.9, and semiconductor or conductor behavior when R < 0.8. However, in some cases, semiconductor behavior was observed when CaO-coated samples with R > 0.98 were exposed in liquid lithium. Based on these studies, they conclude that semiconductor behavior occurs if a conductive calcium vanadate phase is present in localized regions in the CaO coating.

NTIS

Insulation; Metal Films; Vanadium; Vanadium Alloys; Vapor Deposition

19990026719 Department of the Navy, Washington, DC USA

IR Transmitting Rare Earth Gallogermanate Glass-Ceramics

Bayya, Shyam S., Inventor; Harbison, Barry B., Inventor; Sanghera, Jasbinder S., Inventor; Aggarwal, Ishwar D., Inventor; Jul. 28, 1998; 5p; In English; Supersedes US-Patent-Appl-SN-751218

Patent Info.: Filed 15 Nov. 96,; US-Patent-Appl-SN-751,218; US-Patent-5,786,287

Report No.(s): AD-D019177; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A glass-ceramic article or composition which has better thermal and physical properties than the competing materials of zinc sulfide, spinel, or magnesium fluoride comprising 2-30 mole percent yttrium oxide and/or rare earth oxide 25-80 mole percent germanium oxide and 5-30 mole percent gallium oxide based on the total moles of yttrium oxide and/or the rare earth oxide, germanium oxide, and gallium oxide; which article is over 80% by volume crystalline.

DTIC

Ceramics; Infrared Radiation; Rare Earth Compounds; Gallium; Glass

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.

19990026079 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia

TNAZ Based Melt-Cast Explosives: Technology Review and AMRL Research Directions

Watt, Duncan S., Defence Science and Technology Organisation, Australia; Cliff, Matthew D., Defence Science and Technology Organisation, Australia; Jul. 1998; 46p; In English

Report No.(s): DSTO-TR-0702; DODA-AR-010-600; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001), Hardcopy, Microfiche

1,3,3-Trinitroazetidine (TNAZ) is a high density, melt-castable explosive with the potential to replace TNT in melt-cast systems. The purpose of this review is to examine work performed to date and to identify technology gaps Aeronautical and Maritime Research Laboratory (AMRL) needs to address to permit its use in Australian Defense Force applications. Synthetic work is well advanced, with pilot-plant scale operations in use. Chemical and physical characterization has been extensively performed, as has hazard assessment, however, certain sensitiveness results vary and will require further evaluation. Three studies of thermal decomposition have been performed and show similar trends with decomposition occurring via consecutive NO2 losses. The decomposition gases have largely been identified. Calculated and experimentally measured explosive properties show TNAZ to have an explosive performance similar to HMX and substantially improved over that of TNT. High quality pressed charges can be consistently produced, but melt-casting of TNAZ has not yet been perfected. Identified AMRL research directions include addressing melt-cast technology and examining TNAZ as a TNT-replacement in TNT/nitramine melt-cast fillings.

Author

Explosives; Thermal Decomposition; Nitrogen; Oxygen; Chemical Composition; Chemical Explosions

19990026090 Prins Maurits Lab. TNO, Rijswijk, Netherlands

Lifetime of DEGDN (Double-Base) Propellant PH6896 According to STNAG (Standards) 4527 ***Final Report Levensduurvoorspelling van DEGDN-kruit PH 6896 volgens STANAG 4527***

Eerligh, R., Prins Maurits Lab. TNO, Netherlands; October 1998; 28p; In Dutch; Original contains color illustrations

Report No.(s): TD98-0307; TNO-PML-1998-B66; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The chemical life-time of a double-base propellant with 2-nitrodiphenylamine as stabiliser was determined according to STANAG 4527. The determination was performed for NATO AC/310 (SGI) in order to establish acceptance criteria for a stability test for this type of propellant. The procedure consist of the aging of the propellant at 50, 60 and 70 C, followed by the analysis of the stabilizer content using liquid chromatography. According to pseudo first order kinetics the activation energy of the stabiliser consumption was 131 kJ/mole. The stabiliser concentration will be halved in 78 years at a storage temperature of 25 C.

Author

Life (Durability); Stability Tests; Double Base Propellants; Acceptability

19990026118 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia

Numerical Simulation of Detonation in Condensed Phase Explosives

Jones, D. A., Defence Science and Technology Organisation, Australia; Kemister, G., Defence Science and Technology Organisation, Australia; Borg, R. A. J., Defence Science and Technology Organisation, Australia; Aug. 1998; 40p; In English; Original contains color illustrations

Report No.(s): DSTO-TR-0705; DODA-AR-010-605; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

This report describes the development of a two-dimensional multi-material Eulerian hydrocode to model the effects of detonating condensed phase explosives on surrounding materials. The code solves the Euler equations for the conservation of mass, momentum, and energy for an inviscid, compressible fluid. Operator splitting is used to reduce the two-dimensional calculation into coupled one-dimensional equations, which are then solved using the Flux-Corrected Transport (FCT) algorithm of Boris and Book. Non-reacting materials are described using either a perfect gas, Mie-Gruneisen, or Tait equation of state, while the energetic materials are described using either a BKW equation of state and Forest Fire reaction rate model, or the JWL equation of state and the Ignition and Growth reaction rate model. A modified Young's algorithm is used to maintain a sharp interface between different materials on the computational mesh. A brief description of the major components of the coding is provided, and then several applications of the code are described, including the simulation of bullet impact experiments, the underwater sympathetic detonation test, and the modified gap test.

Author

Numerical Analysis; Detonation; Condensing; Explosives; Mathematical Models; Two Dimensional Models; Ignition; Compressible Fluids

19990026198 Army Research Lab., Sensors Directorate, Adelphi, MD USA

Causes of Electromagnetic Radiation From Detonation of Conventional Explosives: A Literature Survey ***Interim Report, Dec. 1995 - Dec. 1997***

Fine, Jonathan E.; Vinci, Stephen J.; Dec. 1998; 49p; In English

Report No.(s): AD-A359740; ARL-TR-1690; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A literature survey was conducted on the presence of electromagnetic radiation from the detonation of conventional explosives. This survey is part of a technology effort to identify a useful battlefield signature that an individual soldier could detect. Sources reported observations of such signals in the range from as low as 0.5 Hz up to 2 GHz. Several of the investigators believed that the likeliest cause was charged particles created by ionization within the explosive region. The frequencies of the radiation appear related to the duration of shock waves and other hydrodynamic phenomena caused by the detonation. A calculation model presented in the literature provides estimates of frequency bands in this range and also of signal levels produced. The model is used to analyze some of the published results and provide some correlation between observations of several investigators.

DTIC

Explosives; Electromagnetic Radiation; Detonation; Charged Particles

19990026632 Department of the Navy, Washington, DC USA

Fuel Delivery System

Escobar, Michael J., Inventor; Jul. 14, 1998; 8p; In English; Supersedes US-Patent-Appl-SN-696587

Patent Info.: Filed 24 Jul. 96,; US-Patent-Appl-SN-696,587; US-Patent-5,780,729

Report No.(s): AD-D019249; No Copyright; Avail: US Patent and Trademark Office, Microfiche

This report describes a engine fuel delivery system for vehicles under test, which effectively limits the quantity of fuel under pressurization at any given time during a test sequence of the vehicle's engine. The system thus effectively reduces the magnitude of an explosion which may be caused by pressurization of fuel, and thus the scale of any damage, associated with any inadvertent detonation of pressurized engine fuel.

DTIC

Fuel Systems; Delivery; Detonation; Explosions

19990026666 Department of Energy, Washington, DC USA

RX-08-HD, a low-viscosity, injection-moldable explosive for filling tortuous paths

Hoffman, D. M., Department of Energy, USA; Jessop, E. S., Department of Energy, USA; Swansiger, R. W., Department of Energy, USA; Oct. 01, 1997; 16p; In English; Insensitive Munitions and Energetics Technology, USA

Report No.(s): DE98-051119; UCRL-JC-127540; CONF-9710123; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Cast cure, extrusion cast, and paste extrudable explosives have not been designed for transferring through long tortuous paths or into fine three dimensional shapes. to allow the crystalline explosive to flow a lubricating fluid is required. The energetic liquid ethane trinitrate (TMETN) was used as the lubricant to maximize the explosive energy. TMETN is a liquid nitrate ester which requires stabilization with conventional free radical stabilizers such as 2- nitrodiphenylamine, methyl-nitroanaline, or ethyl centrylite. Since these injection moldable explosives are expected to cure in place, a polyesterurethane binder based on polymeric isocyanate of hexamethylene diisocyanate and polycaprolactone polyols is dissolved in TMETN. The solubility of the polymer precursors in TMETN also reduces the energetic liquids sensitivity. The latent cure catalyst Dabco T-131 was used to minimize shrinkage associated with thermal expansion, reduce cost associated with oven cures, to give 4-6 hour potlife and overnight cure to handling strength. The product RX-08-HD is a new, low-viscosity, injection moldable explosive that can be extruded into complex, void-free shapes. Combined with appropriate design and other aspects of weaponization, RX-08-HD has produced outstanding results.
NTIS
Viscosity; Binders (Materials); Crystallinity; Ethyl Compounds; Explosives; Methyl Compounds

19990026723 Advanced Fuel Research, Inc., East Hartford, CT USA
In-Situ Methods for Study of Fuel Thermal Stability ***Final Report, 29 Apr. 1994 - 28 Feb. 1995***
Serlo, Michael A.; Kroo, Erlic; onanno, Anthony S.; Knight, Kim S; Farquharson, Stuart; Feb. 1995; 61p; In English
Contract(s)/Grant(s): F33615-94-C-2434
Report No.(s): AD-A360073; 526031; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
The objective of this work was to develop a methodology for in-situ optical measurements of peroxide decomposition products from aviation fuels and demonstrate how this information could be related to fuel stability. Three fiber optic probes (2 Mid-IR, 1 Near-IR) were designed and constructed, and used to monitor the changes in composition of two fuels (Shell Jet A #2827 and Sun Jet A-1 #2747) after thermal stressing. Both mid-IR probes were found to be very sensitive to changes in fuel composition. The large gap (1 mm) IR cell was used to make in-situ IR transmission measurements for peroxide decomposition products, including carbonyls (free and acid form), alcohols, and CO2 (two forms). These measurements were consistent with the generally accepted free radical mechanism of fuel degradation, including the inverse relationship between oxidative and thermal stability. The data from the small gap (0.1 mm) IR cell were found to be consistent with changes in deposit formation tendencies with temperature for similar fuels reported in the literature. In an option task, an FT-Raman probe was evaluated and found to be much less sensitive than the Mid-IR probes. This disadvantage may be remedied by the use of a surface enhanced probe. The potential applications include an instrument for development and evaluation of thermally stable fuels or supercritical fuels, improved global models of fuel degradation mechanisms, and on-board monitors of fuel thermal stability.
DTIC
Thermal Stability; Jet Engine Fuels; Aircraft Fuels

31
ENGINEERING (GENERAL)

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

19990025383 Department of the Army, Washington, DC USA
Army Research, Development and Acquisition: The Year 2000 Challenge... What Lies Ahead?, ***Jan. - Feb. 1999***
Jan. 1999; 63p; In English
Report No.(s): AD-A359191; DA-PB-70-99-1; No Copyright; Avail: Issuing Activity, Microfiche
In the 20th century, scientific discovery and technological innovation have advanced America's military capabilities to the point where we are now the world's mightiest nation. We have before us an unprecedented opportunity to modernize our forces for the 21st century without worrying about a strategic rival that could threaten our existence. Our concerns look to the future. Who will be our future adversaries? What technologies will they employ? How do we maintain our technological edge in the 21st century? Technological superiority is an important component of military advantage. Military advantage goes to the nation best able to capture commercial technologies and incorporate them into weapon systems with new or improved operational capabilities. In large measure, the future readiness and effectiveness of America's Army will be determined by our investments in a relevant technology base. How do we determine whether the Army is investing in the right technologies to ensure military advantage in the 21st century, particularly for the Army After Next (AAN) in the year 2025 and beyond? And, how do we work with our industry partners to leverage their technological advances for military use? These are not easy questions, but they must be

answered. The real challenge is to identify which technologies the Army must develop and which we can expect to buy from the commercial marketplace.
DTIC
Research and Development; Technology Utilization; Acquisition; Industries

19990025493 Naval Postgraduate School, Dept. of Mechanical Engineering, Monterey, CA USA
Determination of Diesel Engine Cylinder Gas Torques from Speed Fluctuations with A High-Fidelity Crankshaft Torsional Model
Swanson, William J.; Dec. 1998; 124p; In English
Report No.(s): AD-A359161; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

An experimental investigation was conducted to develop a method of predicting cylinder indicated torques in a reciprocating engine by measurement of crankshaft angular velocity fluctuations. Cylinder indicated pressures were measured for all three cylinders of a two-stroke Diesel engine with pressure transducers. Time-resolved angular position was measured at the crankshaft front and at the flywheel. A six degree-of-freedom torsional crankshaft model was developed. Two solution methods are described to solve the equations of motion: a time-marching ODE solver, and a Finite Element solution in the time domain. Using these methods with the measured cylinder torques, the angular positions are predicted and compared to measured angular positions for model calibration. An inverse solution method was developed to determine the cylinder indicated torques from the measured angular position at the crankshaft endpoints. The method is theoretically demonstrated to be useful for explicit solutions for two-stroke engines up to three cylinders, and four-stroke engines up to four cylinders. Experimental results show that the method is useful in predicting cylinder indicated torques from angular velocity measurements.
DTIC
Diesel Engines; Equations of Motion; Torque; Angular Velocity

19990025664 NASA Goddard Space Flight Center, Greenbelt, MD USA
Development and Testing of the CRYOTSU Flight Experiment
Bugby, David C., Swales Aerospace, USA; Stouffer, Charles J., Swales Aerospace, USA; Hagood, Robert M., Swales Aerospace, USA; Rich, Michael, Air Force Research Lab., USA; Tomlinson, B. J., Air Force Research Lab., USA; Davis, Thomas M., Air Force Research Lab., USA; Ku, Jentung, NASA Goddard Space Flight Center, USA; Swanson, Theodore D., NASA Goddard Space Flight Center, USA; 1998; 7p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper describes the development and ground testing of the CRYOTSU thermal management flight experiment. CRYOTSU incorporates three cryogenic temperature experiments and one ambient temperature experiment into a Hitchhiker (HH) Get Away Special (GAS) Canister that is currently scheduled to fly on STS-95 in October 1998. The cryogenic experiments consist of a nitrogen triple-point cryogenic thermal storage unit (CTSU), a nitrogen cryogenic capillary pumped loop (CCPL) and a hydrogen gas-gap cryogenic thermal switch (CTSW). The ambient experiment is a carbon-fiber core, paraffin-filled thermal storage unit. Test results of integrated flight canister testing are provided herein for the CTSU and CCPL experiments. Pre-integration laboratory test results are provided for the CTSW. Design information and test results for the ambient experiment are not included.
Author
Flight Tests; Cryogenic Temperature; Get Away Specials (STS); Nitrogen; Ambient Temperature; Space Transportation System

19990025752 Oxford Univ., Dept. of Engineering Science, Oxford UK
Cycle-By-Cycle Variation in Spark Ignition Internal Combustion Engines
Ball, Jeffrey K.; Jan. 07, 1999; 253p; In English
Report No.(s): AD-A359025; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

The primary objective of this work was to extend the engine cycle simulation used by the Oxford Internal Combustion Engine Group to enable it to perform cycle-by-cycle modelling. A literature review concluded that the most appropriate metric for quantifying the cyclic variation was the coefficient of variation of the indicated mean effective pressure, and that for zero dimensional computer simulations, the most sensible parameter to perturb for cycle-by-cycle modelling was the burn rate. Modelling attempts using burn rate information alone resulted in an under-prediction of the cyclic variability exhibited by the engine. The work then examined a two-zone polytropic process model in an attempt to improve burn rate estimation. The model proved unreliable for burn rate calculations. The Rassweiler and Withrow method was then modified to include both the compression and expansion indices throughout the combustion period. The technique proved viable, but was not used because the slow burn up of the significant crevice mass in the experimental engine made calculation of an accurate expansion index doubtful. A further cause of the under-prediction in cyclic variability was postulated to be incomplete combustion, which is not detected by the burn rate model. A completeness of combustion parameter was derived from information contained in the Rassweiler and Withrow analysis. This

parameter was used along with burn rate variations to perturb the cycle simulation and resulted in good cycle-by-cycle agreement between the experimental data and the modelled data in terms of mean effective pressure, maximum pressure, and the phasing of maximum pressure. Cyclic measurements of NO showed that the technique did not predict the cyclic variability in NO formation, and this was attributed to the sensitivity of NO formation to parameters that were not allowed to vary on a cyclic basis within the model (such as residuals).
DTIC
Internal Combustion Engines; Computerized Simulation

19990025940 Naval Facilities Engineering Service Center, Port Hueneme, CA USA
Test Report of Media Protection Systems ***Final Report, Dec. 1997 - Dec. 1998***
Vella, Victor A.; Jan. 21, 1999; 21p; In English
Report No.(s): AD-A359560; NFESC-TM-2308-SHR; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Department of Defense (DoD) Lock Program at the Naval Facilities Engineering Service Center (NEESC) conducted an investigation of the fire protection capabilities of commercially available media protection products, specifically those containers that fit inside GSA approved security file cabinets. Due to weight and cost restrictions, in August 1991 the General Services Administration (GSA) canceled the specification for fire-resistant security containers. Since that time fire protection has been provided mainly by duplicating and storing information in remote, secure vaults. This procedure can be prohibitively expensive. Technology has now provided improved methods for reducing damage caused by fire. The majority of sensitive and classified information is now recorded on digital electronic media. This media permits the storage of vast amounts of information on small magnetic tapes, compact discs, or ”floppy” disks. Commercial ”fireproof” containers are now available that are small enough to fit within legal-size GSA-approved Class 6 security file cabinets. These new products, called media protection systems, can protect small volumes of electronic media from intense structural fires. The DoD Lock Program hired a nationally recognized fire test facility to conduct fire tests on ten commercially available products. Underwriters’ Laboratories UL-72, Class 125 standard test for fire resistance was used. This test simulates the heat stress of common structural fires. The tests determined that two commercial media protection systems, the Fire Cooler 1000 and Fire Cooler 1100, met the requirements of UL-72 Class 125. These products are recommended for the protection of magnetic storage media.
DTIC
Cases (Containers); Magnetic Materials; Fire Prevention; Magnetic Storage; Flame Retardants

19990025976 Air Force Research Lab., Wright-Patterson AFB, OH USA
Missile Fin Heat Pipe Cooling ***Final Report, 1 Jun. 1995 - 1 Jun. 1998***
Donovan, Brian D.; Chang, won S.; Gottschlich, Joseph M.; May 1998; 66p; In English
Contract(s)/Grant(s): Proj-ARMP
Report No.(s): AD-A358663; AFRL-PR-WP-TR-1998-2066; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The main objective of this project was to determine if heat pipe technology could be used to cool the portion of a missile’s control surfaces heated by hot exhaust gas. The goal was to reduce the heat conducted into the body of the missile and its actuation rod. The small portion of the airfoil near the missile body heated by the exhaust plume is to be cooled by rejecting the heat to the large portion of the fin moving through ambient air. It is a ground-to-ground missile with a maximum speed of about Mach 0.75, but the evaporator will see exhaust gas (after shock) at mach 0.89 and 1213 K. The heat pipe was built inside a NACA 0015 airfoil of chord length 0.1143 m, the first 0.05 m of the fin will be heated by the exhaust plume. The report summarizes the aerodynamic heat and cooling approximations used, basic heat pipe theory, design specifications for the missile fin test article, transient heat pipe start-up calculations, experimental setup and testing of the proof-of-concept test article.
DTIC
Aerodynamic Heating; Control Surfaces; Design Analysis; Evaporators; Exhaust Gases; Heat Pipes; High Temperature Gases

19990026000 Department of Energy, Washington, DC USA
Concurrent materials and process selection in conceptual design
Kleban, S. D., Department of Energy, USA; Dec. 31, 1998; 4p; In English; Artificial intelligence and manufacturing
Report No.(s): DE98-003544; SAND-98-1495C; CONF-980814; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The sequential manner in which materials and processes for a manufactured product are selected is inherently less than optimal. Designers’ tendency to choose processes and materials with which they are familiar exacerbate this problem. A method for

concurrent selection of materials and a joining process based on product requirements using a knowledge-based, constraint satisfaction approach is presented.
NTIS
Concurrent Processing; Design

19990026078 Cincinnati Univ., Aerospace Engineering and Engineering Mechanics, OH USA
Structural Similitude and Scaling Laws
Simitses, George J., Cincinnati Univ., USA; November 1998; 7p; In English
Contract(s)/Grant(s): NAG1-1280; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Aircraft and spacecraft comprise the class of aerospace structures that require efficiency and wisdom in design, sophistication and accuracy in analysis and numerous and careful experimental evaluations of components and prototype, in order to achieve the necessary system reliability, performance and safety. Preliminary and/or concept design entails the assemblage of system mission requirements, system expected performance and identification of components and their connections as well as of manufacturing and system assembly techniques. This is accomplished through experience based on previous similar designs, and through the possible use of models to simulate the entire system characteristics. Detail design is heavily dependent on information and concepts derived from the previous steps. This information identifies critical design areas which need sophisticated analyses, and design and redesign procedures to achieve the expected component performance. This step may require several independent analysis models, which, in many instances, require component testing. The last step in the design process, before going to production, is the verification of the design. This step necessitates the production of large components and prototypes in order to test component and system analytical predictions and verify strength and performance requirements under the worst loading conditions that the system is expected to encounter in service. Clearly then, full-scale testing is in many cases necessary and always very expensive. In the aircraft industry, in addition to full-scale tests, certification and safety necessitate large component static and dynamic testing. Such tests are extremely difficult, time consuming and definitely absolutely necessary. Clearly, one should not expect that prototype testing will be totally eliminated in the aircraft industry. It is hoped, though, that we can reduce full-scale testing to a minimum. Full-scale large component testing is necessary in other industries as well, Ship building, automobile and railway car construction all rely heavily on testing. Regardless of the application, a scaled-down (by a large factor) model (scale model) which closely represents the structural behavior of the full-scale system (prototype) can prove to be an extremely beneficial tool. This possible development must be based on the existence of certain structural parameters that control the behavior of a structural system when acted upon by static and/or dynamic loads. If such structural parameters exist, a scaled-down replica can be built, which will duplicate the response of the full-scale system. The two systems are then said to be structurally similar. The term, then, that best describes this similarity is structural similitude. Similarity of systems requires that the relevant system parameters be identical and these systems be governed by a unique set of characteristic equations. Thus, if a relation or equation of variables is written for a system, it is valid for all systems which are similar to it. Each variable in a model is proportional to the corresponding variable of the prototype. This ratio, which plays an essential role in predicting the relationship between the model and its prototype, is called the scale factor.
Derived from text
Aircraft Structures; Component Reliability; Dynamic Tests; Full Scale Tests; Manufacturing; Mission Planning; Prediction Analysis Techniques; Scale Models; Structural Design

19990026447 Department of the Navy, Washington, DC USA
Reconfigurable Multiple Component Load Measuring Device
Gieseke, Thomas J., Inventor; Sep. 11, 1998; 14p; In English
Patent Info.: Filed 11 Sep. 98,; US-Patent-Appl-SN-09/152,476
Report No.(s): AD-D019163; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

A force measurement device that includes a lower support platform. An upper support platform is positioned in spaced relation above the lower support platform. A plurality of members also connects the lower support platform and the upper support platform. On each connecting member there is a load cell, which indicates changes in stress in the members.
DTIC
Measurement; Measuring Instruments; Connectors

19990026453 Department of the Navy, Washington, DC USA
System For Positioning Boresight Calibration Tools
Farley, William L., Inventor; Sep. 29, 1998; 10p; In English
Patent Info.: Filed 29 Jul. 97,; US-Patent-Appl-SN-903,330; US-Patent-5,813,279
Report No.(s): AD-D019174; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A system useful in boresight calibration of a launch cell is provided. The launch cell has a central longitudinal axis coincident with a central longitudinal axis of a projectile that it would support. The launch cell terminates at either end thereof in a door where each door is provided with a hole through which the projectile can pass. The center of the hole is coincident with the central longitudinal axis of the launch cell. The present invention positions a boresight calibration tool relative to the central longitudinal axis of the launch cell. An open-ended first tube is sized for engagement in the hole. The first tube terminates at a first end thereof in a flange that abuts the door when the first tube is inserted into the hole from one side thereof. An open-ended second tube is sized for engagement in the hole from the other side thereof. The second tube terminates at a first end in a flange that is adjacent the door when the second tube is inserted into the hole. The second tube also includes means for supporting a variety of boresight calibration tools at the first end thereof. The first tube is coupled to the second tube when they are engaged in the hole. Provision is made to adjust the spacing between the flange of the second tube and the door in order to ”square up” the system. The system remains square even when boresight calibration tools are interchanged.
DTIC
Calibrating; Boresights; Projectiles

19990026624 Department of the Navy, Washington, DC USA
Mobile Safety Structure with Separate Compartments for Containment and Handling of Hazardous Materials
Payne, Edward, Inventor; Jul. 28, 1998; 14p; In English; Supersedes US-Patent-Appl-SN-813266
Patent Info.: Filed 7 Jan. 97,; US-Patent-Appl-SN-813,266; US-Patent-5,785,591
Report No.(s): AD-D019186; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A mobile safety structure with separate compartments for containment and handling of hazardous materials which includes a roof assembly. a base assembly having a containment pan right side and left side walls and front and rear walls with the front and right side walls having at least one door allowing for access to the interior of the structure. A removable grating is also included in the mobile safety structure which rest atop the base assembly. The removable grating allows the user of the structure to remove hazardous materials from the containment pan by use of a pump. and to visually inspect the containment pan for hazardous materials. There is positioned within the structure four upstanding interior walls which extend from the roof assembly through the floor to a bottom plate of the base assembly to form five separate compartments and associated containment pans within the mobile safety structure’s interior. Each interior wall has a fire proof door which allows access between adjacent compartments. The interior and exterior walls, and roof assembly provide a strong structural enclosure which allows the user of the structure to adapt the structure for use under varying climatic conditions. The interior and exterior walls. and roof also have at least a four hour fire rating.
DTIC
Hazardous Materials; Containment; Structural Properties (Geology)

19990026631 Department of the Navy, Washington, DC USA
Device for Inserting a Linear Array Module into Long Small Diameter Pressure Vessels
Kanel, Amir, Inventor; Aug. 04, 1998; 6p; In English; Supersedes US-Patent-Appl-SN-696589, AD-D018220.
Patent Info.: Filed 24 Jul. 96,; US-Patent-5,788,222; US-Patent-Appl-SN-696,589
Report No.(s): AD-D019248; No Copyright; Avail: US Patent and Trademark Office, Microfiche

An apparatus for loading a linear array module into a pressure vessel includes a first rotatable winch positioned adjacent a first end of the pressure vessel, a second rotatable winch positioned adjacent a second end of the pressure vessel, a movable belt initially wrapped around the first rotatable winch, and a device for attaching the linear array module to the movable belt. First and second pulling members are attached between first and second ends of the linear array module and the first and second rotatable winches, respectively, and a device for selectively engaging and disengaging the first and second rotatable winches, according to a direction of movement of the movable belt through the pressure vessel is provided. Upon engagement of the second rotatable winch and disengagement of the first rotatable winch, the movable belt transportingly supports the linear array module into an interior of the pressure vessel, and upon engagement of the first rotatable winch and disengagement of the second rotatable winch, the movable belt transportingly supports the linear array during an extraction thereof from the interior of the pressure vessel.
DTIC
Linear Arrays; Extraction; Winches

19990026659 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Interpretive summary of the 1997 conference on policies for fostering sustainable transportation technologies
Santini, D. J., Department of Energy, USA; Dec. 31, 1997; 20p; In English, USA
Report No.(s): DE98-057802; ANL/ES/CP-95588; CONF-9708182-SUMM; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

T.R. Lakshmanan, director of the Bureau of Transportation Statistics, offered the following definition from the Bruntland Commission: 'Sustainable development is development that meets the needs of the present generations without compromising the ability of future generations.' The technologies and policies that received the most attention would provide per-unit-of-service reduction of three kinds of social costs (external costs, in economist's terminology) with respect to light duty transportation. The main factors to be reduced were oil use, greenhouse gases, and air pollution. Undesirable side effects of continually expanding transportation activity, including congestion and habitat loss, were also discussed. The conference included debate about priorities among these five categories of social cost, about which organizations should take action to achieve the reductions needed in each, and about what specific actions these organizations should take.
NTIS
Policies; Transportation; Environments

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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.

19990025220 Defence Research Establishment Ottawa, Ottawa, Ontario Canada
Detection and Tracking of Low-Altitude Aircraft Using HF Surface-Wave Radar
Chan, Hing C.; Dec. 1998; 106p; In English
Report No.(s): AD-A359266; DREO-TR-1334; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

A series of aircraft-detection trials was conducted using experimental high frequency surface wave radar (HFSWR) facilities located on the east coast of Canada. These trials were part of a research and development project undertaken by DND to demonstrate the HFSWR technology in a wide-area coastal surveillance role. Several aircraft were used in these trials, including a Beechcraft King-Air 200, a Lockheed T-33 and a Canadair Challenger 601 aircraft. Experimental results were in excellent agreement with theoretical predictions. With relatively low averaged power, the King-Air and the Challenger were tracked to beyond 120 km. The ability of the HFSWR to track maneuvering targets was demonstrated. In addition the radar was shown to be capable of long-range tracking of high-altitude aircraft. Signal processing algorithms for the HFSWR can be improved by exploiting the characteristics of the signal environment measured in these trials.
DTIC
High Frequencies; Surface Waves; Aircraft Detection; Low Altitude; Radar

19990025263 Washington Univ., Dept. of Electrical Engineering, Seattle, WA USA
A Passive Radar for Atmospheric Remote Sensing Using Commercial FM Broadcasts ***Final Report, 1 Aug. 1997 - 1 Aug. 1998***
Sahr, John D.; Aug. 05, 1998; 3p; In English
Contract(s)/Grant(s): F49620-96-1--138
Report No.(s): AD-A359331; AFRL-SR-BL-TR-99-0018; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We are developing a completely passive bistatic radar using commercial FM broadcasts near 100 MHz. by correlating a clean copy of the broadcasts with the weak, delayed scatter at a remote site, we will generate the full range-Doppler profile of ion acoustic turbulence near the auroral electrojets. More precisely we will be calculating the cross ambiguity function of data from two receivers separated by approximately 100 km, intending to detect targets at slant ranges as large as 1000 km. The AFOSR funded portion of this project is now complete. We have completed construction of a fully functional bistatic radar, synchronized in time and frequency using Global positioning System (GPS) technology. We have successfully detected aircraft at ranges as great as 240 km with 1.5 m/s velocity resolution. Detection of aircraft is an important step in detecting auroral turbulence, which has simi-

lar scattered power and Doppler shift. An overview of this work has been presented at two international conferences and resulted in two refereed publications and three MS theses.
DTIC
Atmospheric Sounding; Broadcasting; Remote Sensing; Ion Acoustic Waves; Multistatic Radar; Auroral Electrojets; Doppler Effect

19990025275 Army Construction Engineering Research Lab., Champaign, IL USA
Delivery and Test of the Digital Hardhat System at U.S. Army Corps of Engineers Fort Worth District Office ***Final Report***
Stumpf, Annette; Liu, Liang Y.; Kim, Chul-Soo; Chin, Sangyoon; Dec. 1998; 97p; In English
Report No.(s): AD-A359229; CERL-ADP-99/16; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

Quality assurance at military construction sites presents a challenge for the Corps of Engineers and other participants. The cost and time required to travel between sites limits the ability of personnel to quickly respond to problems at remote sites and to communicate issues between all necessary decision makers. Also, it is difficult to organize and transmit multimedia project information (digital pictures, video, electronic documents, and audio recordings) so that others can access current project information in an intuitive and timely manner. The Digital Hardhat (DHH) technology enables dispersed users to capture and communicate multimedia field data to collaboratively solve problems, and collect and share information. The DHH is a pen-based personal computer with special Multimedia Facility Reporting System software that allows the field representative to save multimedia information into a project-specific database, which is then accessible to others through the World Wide Web.
DTIC
Digital Systems; Data Bases; Digital Television; Quality Control

19990025443 Defence Research Establishment Ottawa, Ottawa, Ontario Canada
MDR/Omni-band Reconfigurable Terminal: Design Concept
Addison, Robin D.; Sep. 1998; 45p; In English
Report No.(s): AD-A359265; DREO-TN-98-007; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In 1997, Defence Research Establishment Ottawa and Communications Research Centre started research into an omni-band reconfigurable terminal. Such a terminal will enable armed forces personnel to use a single ground terminal to communicate over any satellite communications or terrestrial link. Each ground terminal will support multiple standards. The first one to be implemented will be extremely high frequency medium data rate communications. There are two simulators: the payload simulator and the ground terminal simulator. Each simulator has a personal computer based host to run the simulator, a digital chassis containing several digital signal processor boards to run the payload or ground terminal, and a radio frequency chassis to interface to the digital boards. Within the simulators, the concentration is on the capability to reconfigure. This will allow easy implementation of different standards for different communications systems. Debugging capabilities will be incorporated at the beginning of the design phase to facilitate development and simplify testing. The sequence of development, from the initial concept of a medium data rate simulator to industrial development of an omni-band reconfigurable terminal, is given. Initial development concentrates on baseband processing with the radio frequency research in parallel. Midway through, the simulator will be ready for international interoperability testing. Later, additional standards will be supported. Throughout the development, industry will be consulted for the eventual transfer of the technology to industry for development of omni-band reconfigurable terminals for the Canadian Forces.
DTIC
Digital Systems; Communication Networks; Telecommunication; Signal Processing; Program Verification (Computers)

19990025489 ViA, Inc., Northfield, MN USA
Wearable Language Translation ***Quarterly Report, 22 Dec. 1998 - 15 Jan. 1999***
Carroll, Wendell, ViA, Inc., USA; Palmquist, Robert, ViA, Inc., USA; Jan. 15, 1999; 35p; In English
Contract(s)/Grant(s): N00014-99-M-0009
Report No.(s): AD-A359072; VIA-0001AA; TOPIC-N98-144; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

VIA Team Mission Statement: to develop a near real time, two way, mobile, lightweight, robust and low cost multi-lingual language translation device that can be operated with minimal training in a hands free manner. This report describes the current status of ViA's Phase 1 SBIR to develop a mobile language translator. The objectives of this Phase 1 research effort are as follows: (1) Investigate the scientific, technical and commercial merit and feasibility of the system described in the preceding mission statement; (2) use the results of this investigation to select the best approach for the language translator system; (3) Develop a working prototype that will be delivered to the government representative. There are three technical areas that are being investigated: (1) the mobile computer platform; (2) the operator interface; and (3) the language translation software. The commercial feasibility

study includes identifying potential applications, languages to be supported, cost, and user requirements such as performance specifications, system weight and acceptable battery life. By combining both the commercial and technical elements, the ViA team is developing a complete definition and functional prototype of a mobile, near real time language translation device.
DTIC
Functional Design Specifications; Machine Translation; Languages

19990025564 Colorado Univ., Colorado Springs, CO USA
TCP/IP over ATM via Satellite Links
Kuehne, Timothy P., Colorado Univ., USA; May 04, 1998; 32p; In English
Report No.(s): AD-A359065; AFIT-FY99-21; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Living in the Information Age means that the more information is generated, the more new information is required. A large contributor to the rapid increase of new information and its ease of accessibility is the Internet. The backbone of the Internet is the TCP Internet protocol. New emerging network technology, ATM, achieves data throughput never before possible. Layering TCP/IP over ATM will increase throughput performance that TCP/IP could not achieve alone. With the growing desire to use satellites as a medium for the Internet as well as the large amounts of digitized communication that already occurs daily via satellites, the TCP/IP proposes to become a standard for satellite communication. The high data rates of ATM, however, is very appealing for use on satellite links in an effort to make them more cost effective. Obstacles exist which prevent TCP/IP over ATM in its current state from becoming an efficient way to send information to and from satellites. This paper looks at the unique challenges of networking via satellite links, discusses the impact of the satellite links on TCP/IP over ATM and the limitations of TCP/IP which are caused, and investigates solutions to these limitations.
DTIC
Asynchronous Transfer Mode; Communication Satellites; Protocol (Computers); Satellite Communication; Internets

19990025710 Department of Defense Health Affairs, Health Services Operations and Readiness, Falls Church, VA USA
Medical Global Command and Control System
Hughes, S. E., Department of Defense Health Affairs, USA; September 1998; 4p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A01, Hardcopy; A04, Microfiche

In response to know deficiencies and advances in technology, information systems within the Department of Defense are migrating to compliance with the Defence Information System Agency's (DISA) Defence Information Infrastructure Common Operating Environment to ensure interoperability. The Medical Health Services System (MHSS) has been working to condense its myriad of non-interoperable systems into a family of interoperable systems that meet the needs of all the same architecture protocols as the tactical operational systems. This interoperability will contribute to improved situational awareness, tactical integrity, and command and control while supporting the warfighter.
Derived from text
Command and Control; Medical Services; Telemedicine; Military Operations

19990025766 Physics and Electronics Lab. TNO, The Hague Netherlands
Target Detection and Recognition with PHARUS *Final Report*
Dekker, R. J.; Groot, J. S.; Jun. 1998; 62p; In English
Report No.(s): AD-A358933; FEL-98-A045; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report describes the possibility of target detection and recognition with PHARUS, a polarimetric c-band airborne SAR. A study is done to several pre-processing, detection and recognition algorithms. Pre-processing is performed to reduce the speckle noise and improve the detection probability. For this study PHARUS data was recorded during the NATO Panel 3 RSG-20 MIMEX trials at Swynnerton (UK) in October 1996, containing a set of stationary military vehicles. Detection turned out to be successful using a combination of a Polarimetric Whitening Filter (PWF) for optimal speckle reduction and an order-statistics CFAR detector. Recognition based on the spatial and polarimetric properties of the detected targets, was not possible because the resolution of PHARUS is insufficient. Because of the good detection performance, PHARUS can be used as a cue for other sensors with a good recognition performance (multi-sensor approach).
DTIC
Algorithms; C Band; Cues; Detection; Multisensor Applications; North Atlantic Treaty Organization (NATO); Polarimetry; Polarization Characteristics

19990025769 Naval Postgraduate School, Monterey, CA USA

Evaluation of and Methods to Reduce Co-Channel Interference on the Forward Channel of a CDMA Cellular System

Mayer, Tanya G.; Dec. 1998; 98p; In English

Report No.(s): AD-A358985; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

The large volumes of information necessary to support today's warfigher require the development of new technology to provide this type of secure, high data rate communication. The flexibility of cellular communications makes it an excellent choice for this purpose. Currently available cellular communications systems are narrowband; that is, they cannot support high data rate applications such as video, full Internet connection, and teleconferencing. Simply increasing the bandwidth of the existing systems will result in severe degradation due to frequency-selective fading, resulting in loss of quality and reliability. Instead, a new wideband cellular system can be used featuring a multicarrier, code division multiple access (CDMA) method. This type of system minimizes the effects of frequency-selective fading while reducing the probability of detection and interception. The limiting factor in this type of system' is co-channel interference. This thesis focuses on analyzing the co-channel interference on the forward channel of the proposed CDMA cellular system and investigating methods such as sectoring and microzoning in an effort to reduce that interference.

DTIC

Bandwidth; Broadband; Code Division Multiple Access; Degradation; Electromagnetic Interference; Flexibility; Frequencies

19990025770 Physics and Electronics Lab. TNO, The Hague Netherlands

COTS Interface FCM *Final Report*

Bierens, L. H., Physics and Electronics Lab. TNO, Netherlands; vantWout, C., Physics and Electronics Lab. TNO, Netherlands; Stijnman, P. A., Physics and Electronics Lab. TNO, Netherlands; Jul. 1998; 43p; In English

Report No.(s): AD-A358987; FEL-98-A052; TDCK-TD98-0138; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report describes the result of the project.

DTIC

Signal Processing; Synthetic Aperture Radar; Data Management

19990025917 Ballistic Missile Defense Organization, Washington, DC USA

Joint Composite Tracking Network (JCTN)-Benefits to Cruise Missile Defense

Waugh, Steve; Jan. 1998; 5p; In English

Report No.(s): AD-A359394; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The Joint Composite Tracking Network (JCTN) concept was developed as a network of sensors that would enable substantial improvements in operational capabilities including the ability to track and destroy cruise missiles. Although it includes a communications element, JCTN is more than a communications network. JCTN is a value-added processing system that includes common software to share and fuse data from participating sensors to create a highly accurate integrated aerospace picture.

DTIC

Cruise Missiles; Missile Defense; Tracking Networks; Communication Networks

19990025925 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA

The Simulation, Modeling and Analysis of Wireless Local Area Networks Supporting the IEEE 802.11 Standard

Joo, Jaikwan; Dec. 1998; 101p; In English

Report No.(s): AD-A359438; AFIT/GCS/ENG/98D-01; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Research to improve the performance of the IEEE 802.11 has been ongoing since 1990. The focus of this research has investigated the use of the MAC and Physical layers for improving throughput. An adaptive MAC protocol, CATER (Code Adapts to Enhance Reliability) is based on the proposed MAC standard for wireless local area networks (WLAN)-802. 11. IEEE 802.11 uses a fixed Pseudo-Noise (PN) code for spreading the information signal, implying a fixed process gain at the receiver. When the channel degrades, IEEE 802.11 offers only retransmissions at the MAC layer to contend with the corrupted medium. However, CATER allows communicating stations to reconfigure their transceivers to use a longer PN code after a prescribed number of failed retransmissions. The longer PN code increases the process gain of the receiver and reduces the error rate. This thesis analyzes the performance of CATER as changing the factor: Start (the number of transmission before the channel is reconfigured) and Max (additional frame transmissions during reconfigure), PN code length, the number of station, and implementing Forward Error Correction (FEC). CATER provides better throughput for smaller Start and larger Max at a high bit error rate (10-3). When CATER uses a PN code length of 63, the throughput is increased by 101 percent at high bit error rate (BER). However, 802.11 is better than CATER at low BER (less than 10-3). As the number of stations is increased, the throughput is decreased, resulting from more

stations contending for the channel to transmit the frames. When FEC is implemented with CATER, the throughput is improved by 156 percent at high BER (> 10-3).
DTIC
Local Area Networks; Radiotelephones; Bit Error Rate; Protocol (Computers); Error Analysis

19990025974 Army Research Lab., Sensors Directorate, Adelphi, MD USA
Time-Varying Electrostatic Modeling Techniques
Hull, David M.; Jan. 1999; 5p; In English
Report No.(s): AD-A358654; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
ARL developed computer models and modeling techniques based on the Method of Moments, and has used them for some time to study electrostatic fields associated with targets, terrain clutter, and sensors of interest. Recent extensions to these unique ARL capabilities allow some dynamic conditions to be modeled as a time series of quasi-static models. These new techniques have enabled us to study the extremely low-frequency (ELF) effects of rotating helicopter blades on both airborne and remote sensors. Examples show how a dynamic helicopter model can be used to compute time-varying airborne fieldmeter calibration factors for aircraft charge and atmospheric electric field measurements, and remote ELF electric fields which might be detected by passive surveillance sensors.
DTIC
Computerized Simulation; Dynamic Models; Electric Fields; Electrical Measurement; Electrostatics; Extremely Low Frequencies; Helicopters

19990026052 Environmental Research Inst. of Michigan, Ann Arbor, MI USA
Formulation of Chirp and Impulse Transmitter Requirements for Synthetic Aperture Radar
Golden, August, Environmental Research Inst. of Michigan, USA; Ressler, Marc A., Army Research Lab., USA; Jan. 1998; 5p; In English
Report No.(s): AD-A358540; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
Chirp and impulse waveform choices are examined for use in a postulated airborne ultra-wideband synthetic aperture radar and parameters for transmitters meeting design requirements are developed.
DTIC
Broadband; Chirp; Impulses; Radar Transmitters; Synthetic Aperture Radar

19990026054 Stanford Univ., Space Telecommunications and Radioscience Lab., Stanford, CA USA
Seasonal Variations of Globally Measured ELF/VLF Radio Noise
Chrissan, D. A.; Fraser-Smith, A. C.; Dec. 1996; 132p; In English
Contract(s)/Grant(s): N00014-92-J-1576; N00014-93-1-1073
Report No.(s): AD-A358414; TR-D177-1; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
The space, telecommunications and radioscience (star) laboratory at stanford has been conducting a global survey of extremely low frequency (elf) and very low frequency (vlf) radio noise since february 1985. Eight measurement stations around the world record the instantaneous noise amplitude in each of sixteen narrow frequency bands in the 10 hz - 32 khz frequency range, and this report presents calculations of the monthly averages for the four stations with the longest times of operation. The data presented here supplement those in a paper in radio science by the same authors; however, this report includes a much more detailed and extensive presentation of the seasonal variation data than does the published paper. Specifically, this report contains: (1) seasonal variation data for specific diurnal time periods, and (2) the seasonal variations for individual years.
DTIC
Extremely Low Frequencies; Very Low Frequencies; Telecommunication; Diurnal Variations

19990026072 Physics and Electronics Lab. TNO, The Hague, Netherlands
Atmospheric Effects on LR-IRST: Model Version 1
vanEijk, A. M. J., Physics and Electronics Lab. TNO, Netherlands; Kunz, G. J., Physics and Electronics Lab. TNO, Netherlands; deLeeuw, G., Physics and Electronics Lab. TNO, Netherlands; Dion, D., Defence Research Establishment Valcartier, Canada; Apr. 1998; 47p; In English
Contract(s)/Grant(s): A94/KM/786; TNO Proj. 24581
Report No.(s): TNO-FEL-95-A-A252; TD96-1640; Copyright; Avail: Issuing Activity (TNO Physics and Electronics Lab., P.O. Box 96864, 2509 JG The Hague, The Netherlands), Hardcopy, Microfiche

A code has been developed to describe atmospheric effects on Long-Range Infra Red Search and Track (LR-IRST) systems. The code is a compilation of existing models and models that were especially developed for this task. State-of-the-art knowledge has been used to calculate molecular and aerosol extinction and turbulence along an over-water propagation path that may cover heights from close to the sea surface to a maximum altitude of 30-50 m. The propagation path can be calculated using a ray tracing program. All calculations are based on meteorological inputs and the heights at which these parameters are measured. The work has been carried out in a cooperation between DREV (Canada) and TNO-FEL (The Netherlands).
Author
Atmospheric Effects; Computer Programs; Ray Tracing; Ocean Surface; Infrared Tracking

19990026428 Norwegian Defence Research Establishment, Kjeller, Norway
Basic HF Propagation, and Introduction to the Prediction Software ICEPAC ***HF Bolgeutbredelse Basiskunnskap, Samt Kort Bruker Veiledning til Prediksjonsprogrammet ICEPAC***
Jodalen, Vivianne, Norwegian Defence Research Establishment, Norway; Bergsvik, Torgeir, Norwegian Defence Research Establishment, Norway; Dec. 11, 1998; 42p; In Norwegian; Original contains color illustrations
Contract(s)/Grant(s): FFIE Proj. 742/110
Report No.(s): FFI/RAPPORT-98/05322; ISBN 82-46400314-1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The main objective of this document is to give the reader a good knowledge of using the RF prediction software ICEPAC (Ionospheric Communications Enhanced Profile Analysis and Circuit prediction program). The first chapter gives an introduction to HF communications by means of ground- and ionospheric support. Chapter 2 discuss the properties of widely used HF antennas. ICEPAC input parameters are described in chapter 3, and this chapter contains some examples of ICEPAC predictions. 'ne last chapter presents results from a comparison of speech, telegraphy and the two modems STANAG 4415 (75 bps) and STANAG 4285 (2400 bps) which is performed with the experimental data from the Doppler and Multipath Sounding Network (DAMSON) project. This is done to show that ICEPAC predictions confirm with experimental data.
Author
High Frequencies; Wave Propagation; Predictions; Radio Frequencies; Computer Programs

19990026429 Norwegian Defence Research Establishment, Kjeller, Norway
HF-Modem Performance Evaluation Based on Measurements of the HF Channel at High Latitudes ***Evaluering Av Hf-Modemer og Flerfrekvenssystemer Basert Pa Kanalmalinger Pa Hoye Breddegrader***
Bergsvik, Torgeir, Norwegian Defence Research Establishment, Norway; Nov. 17, 1998; 98p; In Norwegian; Original contains color illustrations
Contract(s)/Grant(s): FFIE Proj. 742/110
Report No.(s): FFI/RAPPORT-98/04983; ISBN 82-464-0311-7; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche
The high latitude HF channel has been measured and characterized in terms of Doppler spread, delay spread and signal-to-noise ratio. This is done by the Doppler and Multipath Sounding Network developed(DAMSON) by DERA in conjunction with CRC, FOA and FFI. The performance of data modems compliant with STANAG 4285 (2400 bps mode, non-robust) and STANAG 4415 (75 bps mode, robust) has been determined over a comprehensive range of simulated channel conditions. A comparison is made between the channel measurements and the modem characterizations, and modem availabilities during the measured channel conditions are determined. ne robust modem shows 50 - 70% higher availability than the non-robust modem on the measured paths. The most important factor contributing to modem failure is low signal-to-noise ratio. This report also addresses the number of frequencies required for a HF circuit to achieve maximum communications availability. Results from all DAMSON paths show that STANAG 4285 requires 6 - 8 frequencies whereas the STANAG 4415 modem reaches maximum availability with 2 - 3 frequencies.
Author
Performance Tests; High Frequencies; Modems; Evaluation

19990026501 Department of the Navy, Washington, DC USA
Multiplexing/Demultiplexing System for Asynchronous High and Low-Speed Data
Werle, Christian P., Inventor; Jul. 07, 1998; 6p; In English; Supersedes US-Patent-Appl-SN-696084
Patent Info.: Filed 13 Aug. 96,; US-Patent-Appl-SN-696,084; US-Patent-5,778,002
Report No.(s): AD-D019239; No Copyright; Avail: US Patent and Trademark Office, Microfiche
A system and method are provided for multiplexing/demultiplexing asynchronous high-speed digital data and asynchronous low-speed digital data. A first digital signal processor (DSP) receives complete low-speed data messages and is programmed to assemble each complete message into data blocks in accordance with a block format. Each data block is identical in size and

includes provisions for a header that identities the data assembled therein. A second DSP has a plurality of I/O ports, each of which has a direct memory access (DMA) associated therewith. One of the I/O ports is coupled to the first DSP to receive each complete message assembled into data blocks. The other I/O ports are coupled to a second plurality of channels transmitting asynchronous high-speed digital data. The DMAs associated with the other I/O ports are configured to assemble the high-speed data into data blocks in accordance with the same block format used for the low-speed messages. The second DSP is coupled to a data recorder so that each complete message assembled in block format and the high-speed data assembled in block format are transmitted to the data recorder when it is operated in the record mode. The first DSP can have an I/O port thereof coupled to the data recorder. The DMA associated with this I/O port is configured to route the data blocks passed thereto in accordance with the header associated with the data blocks when the data recorder is operated in the playback mode.
DTIC
Input/Output Routines; Multiplexing; Demultiplexing

19990026560 General Accounting Office, National Security and International Affairs Div., Washington, DC USA
Report to the Chairman, Subcommittee on National Security, Committee on Appropriations, House of Representatives. Military Satellite Communications: Concerns with Milstar's Support to Strategic and Tactical Forces
Nov. 1998; 30p; In English
Report No.(s): GAO/NSIAD-99-2; B-278426; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
DOD initiated the Milstar program under Air Force management in the early 1980s. Milstar is intended to be DOD's most robust communications satellite system. It is designed to operate in the extremely high frequency (EHF) radio spectrum, although it has super high frequency and ultra high frequency capabilities, and it was originally designed to transmit signals at low data rates (LDR). Milstar employs computer processing capabilities on the satellites and several different radio signal processing techniques that provide resistance to electronic jamming. Computer processing associated with other DOD communication satellite systems is primarily performed with ground-based equipment and is considered to be less resistant to electronic jamming.
Derived from text
Congressional Reports; Security; Communication Satellites; Satellite Communication; Armed Forces; Project Management; Appropriations

19990026630 Department of the Navy, Washington, DC USA
Model Identification and Characterization of Error Structures in Signal Processing
O'Brien, Fances J., Jr., Inventor; Nguyen, Chung T., Inventor; Bates, Bruce J., Inventor; Jul. 21, 1998; 7p; In English; Supersedes , AD-D018496
Patent Info.: Filed 13 Jan. 97,p; US-Patent-Appl-SN-782,362
Report No.(s): AD-D019242; PAT-5-784,297; No Copyright; Avail: US Patent and Trademark Office, Microfiche
A method for finding a probability density function(pdf) and its statistical moments for an arbitrary exponential function of the form g(x)=alphax(m)e(-betax(n)), 0 less than x less than infinity where alpha, beta, n greater than 0, m greater than -1 are real constants in one dimensional distributions and g(x sub 1,x sub 2,...,x sub 1) in the hyperplane. Non-linear regression analyses are performed on the data distribution and a root-mean-square (rms) is calculated and recorded for each solution set until convergence. The basis function is reconstructed from the estimates in the final solution set and a pdf is obtained. the moment generating function (mgf), which characterizes any statistical moment of the distribution, is obtained using a novel function derived by the inventors and the mean and variance are obtained in standard fashion. Smple hypotheses about the behavior of such functional forms may be tested statistically once the empirical least squares methods have identified an applicable model derived from actual measurements.
DTIC
Regression Analysis; Nonlinearity; Signal Processing; Root-Mean-Square Errors

19990026725 Department of the Navy, Washington, DC USA
Apparatus and Method for Generating Short Pulses for NMR and NQR Processing
Miller, Joel B., Inventor; Garroway, Allen N., Inventor; Sep. 08, 1998; 14p; In English; Supersedes US-Patent-Appl-SN-749483, AD-D018498.
Patent Info.: Filed 15 Nov. 96,; US-Patent-Appl-SN-749,483; US-Patent-5,804,967
Report No.(s): AD-D019169; No Copyright; Avail: US Patent and Trademark Office, Microfiche
An apparatus using nuclear magnetic or quadrupole resonance to detect selected nuclei in a specimen (e.g., specimens containing a class of explosives or narcotics). The apparatus includes a pulsing unit to generate an RF pulse or a train of pseudo-ran-

dom RF pulses used in stochastic NQR. Each of the pulses has an RF signal reaching a full amplitude within a quarter-cycle (substantially no pulse rise delay) and having
DTIC
Nuclear Quadrupole Resonance; Signal Processing; Radio Frequencies

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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.

19990025206 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China
Adaptive Pulse-Pump Controller for X-Y Mode Frequency-Locked Stepping Servomechanism
Hsieh, Guan-Chyun, National Taiwan Univ. of Science and Technology, Taiwan, Province of China; Chen, Liang-Rui, National Taiwan Univ. of Science and Technology, Taiwan, Province of China; Hsieh, Kuan-Lung, National Taiwan Univ. of Science and Technology, Taiwan, Province of China; Wu, Hsun-Chien, National Taiwan Univ. of Science and Technology, Taiwan, Province of China; Hsu, Jui-Hsing, National Taiwan Univ. of Science and Technology, Taiwan, Province of China; Journal of the Chinese Institute of Engineers: Transactions of the Chinese Institute of Engineers, Series A; January 1998; ISSN 0253-3839; Volume 21, No. 1, pp. 47-58; In English
Contract(s)/Grant(s): NSC-84-2213-E-011-056; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A microprocessor-based adaptive pulse-pump controller (muP- APPC) for X-Y mode frequency-locked stepping position servo control system (XY-FLSPS) is proposed. A control strategy in muP-APPC for speeding-up the system locking process is developed. A discrete frequency set is built to represent the servo position so as to raise the accuracy of position lock and reduce the conversion error in the signal processing. The muP-APPC can respectively provide proper X's and Y's motion profiles for guiding their movements according to the detected position errors. An X-Y pulse rate identifier (XY-RI) is built to prescribe the instant X-axis and Y-axis motion speeds so that both X and Y motors can reach the target at approximately the same time. System modeling for analysis and computer simulation is constructed. A prototype of the XY-FLSPS with muP-APPC controller is developed for assessing system performance, and the X-Y position and speed responses are described by three-dimensional display. Author
Stepping Motors; Microprocessors; Servocontrol; Servomechanisms; Controllers; Adaptive Control

19990025218 Defence Research Establishment Ottawa, Ottawa, Ontario Canada
Mutual Coupling Between Rectangular Dielectric Resonator Antenna Elements
Henry, Bruce; Petosa, Aldo; Antar, Yahia M.; Morin, Gilbert A.; May 1998; 136p; In English
Report No.(s): AD-A359245; DREO-1333; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Dielectric resonator antennas (DRAs) have been suggested as a potentially efficient antenna for use in Personal Communication Systems, Global Positioning Systems and wireless computer networks. They offer several advantages, such as high efficiency, large bandwidth, low profile, small size, ease of fabrication, and low production cost. This paper examines characteristics of the rectangular DRA, both as individual radiating elements as well as elements in array environments. Numerical methods are used to obtain detailed information with respect to the resonant frequency, bandwidth, scattering parameters, input impedance, field structures and radiation patterns on which DRA design is based. This obtained information is then used to help in understanding and quantizing the interaction between elements in close proximity, i.e. mutual coupling. This coupling analysis provides important information for the array design process, as well as the necessary information required to positively exploit these coupling characteristics. The simulation software provides data that very closely matches both experimentation and the theoretical models. Mutual coupling measurements indicate that, beyond a spacing of one half-wavelength, there is very little mutual interaction. This mutual coupling was exploited at lesser distances however with parasitically coupled dielectric elements used to create novel single feed multi-element antennas with altered resonant frequencies, increased bandwidth and enhanced radiation patterns, as compared to a single element.
DTIC
Antennas; Computerized Simulation; Coupling; Computer Networks; Antenna Radiation Patterns

19990025256 Naval Research Lab., Fundamental Plasma Processes, Washington, DC USA
On the Theory of Ion Noise in Microwave Tubes ***Interim Report***
Manheimer, Wallace M.; Jan. 15, 1999; 49p; In English
Report No.(s): AD-A359313; NRL/MR/6707--99-8323; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This work examines from a theoretical perspective recent experimental work regarding ion noise in the CPI continuous wave illuminator (CWI) and also earlier related ion measurements on a CW klystron. The measurements are to a large extent complementary, the former doing only microwave measurements, the latter doing only ion current measurements. The measurements are compared to theory which seems applicable. Many result do agree at least qualitatively with theory.
DTIC
Ion Currents; Microwave Tubes; Continuous Radiation

19990025323 Michigan Univ., Dept. of Electrical and Computer Engineering, Ann Arbor, MI USA
Micropackaging for Mm-Wave Circuits ***Final Report, May 1995 - Apr. 1998***
Katehi, Linda P., Michigan Univ., USA; May 01, 1998; 266p; In English
Contract(s)/Grant(s): DAAH04-95-1-0321
Report No.(s): AD-A358982; 033259-1-F; ARO-33939.13-EL; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

Complex antenna and circuit problems including their package on wafer require very intensive calculations due to the need to accurately simulate the underlying high-frequency effects and account for all the parasitic mechanisms. As part of this project, we have successfully applied a novel frequency domain scheme recently developed at the University of Michigan that allows for the very successful and computationally efficient solution of complex antenna problems. This technique has been applied to a variety of circuit and antenna problems and has demonstrated the capability to provide accurate solutions in much more efficient ways than in the conventional techniques. The whole idea in this approach is the use of wavelets in the expansion of the unknown functions. The use of wavelets allows for the computation of the values of the derivatives of the unknown field quantities in addition to the average values of the field. This allows for the development of novel space-adaptive schemes with unique capabilities.
DTIC
Microelectronics; Electronic Packaging; Microwave Circuits; Wavelet Analysis; Millimeter Waves

19990025331 Technological Research and Development Authority, Titusville, FL USA
Universal Signal Conditioning Amplifier ***Final Report, 15 Mar. 1994 - 31 Dec. 1996***
Kinney, Frank, Technological Research and Development Authority, USA; April 1997; 191p; In English
Contract(s)/Grant(s): NCC10-0008
Report No.(s): NASA/CR-97-206401; NAS 1.26:206401; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

The Technological Research and Development Authority (TRDA) and NASA-KSC entered into a cooperative agreement in March of 1994 to achieve the utilization and commercialization of a technology development for benefiting both the Space Program and U.S. industry on a ”dual-use basis”. The technology involved in this transfer is a new, unique Universal Conditioning Amplifier (USCA) used in connection with various types of transducers. The project was initiated in partnership with I-Net Corporation, Lockheed Martin Telemetry & Instrumentation (formerly Loral Test and Information Systems) and Brevard Community College. The project consists of designing, miniaturizing, manufacturing, and testing an existing prototype of USCA that was developed for NASA-KSC by the I-Net Corporation. The USCA is a rugged and field-installable self (or remotely)- programmable amplifier that works in combination with a tag random access memory (RAM) attached to various types of transducers. This summary report comprises performance evaluations, TRDA partnership tasks, a project summary, project milestones and results.
Derived from text
Amplifier Design; Operational Amplifiers; Transducers; Signal Processing; Product Development

19990025337 NASA Goddard Space Flight Center, Greenbelt, MD USA
The Development of Lightweight Electronics Enclosures for Space Applications
Fenske, Matthew T., NASA Goddard Space Flight Center, USA; Barth, Janet L., NASA Goddard Space Flight Center, USA; Didion, Jeffrey R., NASA Goddard Space Flight Center, USA; Mule, Peter, NASA Goddard Space Flight Center, USA; 1999; 15p; In English, May 1999, Long Beach, CA, USA; Sponsored by Society for Advancement of Materials and Process Engineering, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper outlines the end to end effort to produce lightweight electronics enclosures for NASA GSFC electronics applications with the end goal of presenting an array of lightweight box options for a flight opportunity. Topics including the development of requirements, design of three different boxes, utilization of advanced materials and processes, and analysis and test will be dis-

cussed. Three different boxes were developed independently and in parallel. A lightweight machined Aluminum box, a cast Aluminum box and a composite box were designed, fabricated, and tested both mechanically and thermally. There were many challenges encountered in meeting the requirements with a non-metallic enclosure and the development of the composite box employed several innovative techniques.
Author
Thermal Conductors; Enclosure; Spacecraft Electronic Equipment

19990025369 Aeroflex Labs., Inc., Plainview, NY USA
SXI Stepper Motor/Encoder, Part A, Engineering drawings and associated lists
1994; In English
Contract(s)/Grant(s): NAS8-39409
Report No.(s): NASA/CR-94-208160; NAS 1.26:208160; AEROFLEX-P/N-16187; No Copyright; Avail: Issuing Activity (Aeroflex Lab., 35 South Service Rd., Plainview, New York 11803, USA), Hardcopy, Microfiche
This document is comprised of engineering drawings and associated lists of the SXI Stepper Motor/Encoder.
CASI
Blueprints; Engineering Drawings; Stepping Motors; Coders

19990025466 Department of the Navy, Washington, DC USA
Graded Electron Affinity Semiconductor Field Emitter
Shaw, Jonathan L., Inventor; Jensen, Kevin, Inventor; Gray, Henry F., Inventor; Jun. 30, 1998; 14p; In English; Supersedes US-Patent-Appl-SN-498266, AD-D0176655.
Patent Info.: Filed 3 Jul. 95,; US-Patent-Appl-SN-498,266; US-Patent-5,773,920
Report No.(s): AD-D019132; No Copyright; Avail: US Patent and Trademark Office, Microfiche
A field emitter is disclosed comprising a graded electron affinity surface layer. The graded electron affinity layer provides for increased transconductance, reduced energy distribution of emitted electrons, reduced noise and increased uniformity in its operation.
DTIC
Semiconductor Devices; Field Emission; Semiconductors (Materials); Electron Affinity; Transconductance

19990025470 NASA Goddard Space Flight Center, Greenbelt, MD USA
Electrical and Thermal Characteristics of Lithium-Ion Cells
Rao. Gopalskrishna M., NASA Goddard Space Flight Center, USA; Vaidyanathan, Hari, Communications Satellite Corp., USA; 1999; 16p; In English; Applications and Advances, 12-15 Jan. 1999, Long Beach, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The 18,650 type lithium ion cells are characterized by a cell resistance of 130 mOmega, capacity of 1.27 Ah at 25 C, and a mid-discharge voltage of 3.6 V. The capacity loss in the 72-hour stand test was 3.39%. The heat dissipation properties were determined by a radiative calorimeter. During charge, initial endothermic cooling and subsequent exothermic cooling beyond 55% state- of-charge were observed. At C/2 rate of discharge (which is considered medium rate), the heat dissipated was 17 mW/cu cm. The heat dissipation profile during discharge is also unique in the presence of a minimum that is different from that observed for Ni-Cd, Ni-MH, and Ni-H2 cells.
Author
Electric Potential; Lithium; Metal Ions; Thermal Batteries; Thermal Analysis; Heat Measurement

19990025491 Army Research Lab., Sensors Directorate, Adelphi, MD USA
Overcharge Protection in Ambient Temperature Lithium and Lithium-Ion Cells: A Literature Survey ***Progress Report, Oct. 1997 - Sep. 1998***
Behl, Wishvender K.; Dec. 1998; 16p; In English
Contract(s)/Grant(s): Proj-AH47
Report No.(s): AD-A359152; ARL-TR-1803; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This report summarizes a survey of the literature on in situ electrochemical methods to provide overcharge protection in ambient temperature lithium and lithium-ion cells. Among the various rechargeable lithium battery systems, only the lithium cells using solutions of inorganic salts such as LiAlCl4 or LiGaCl4 in sulfur dioxide as electrolytes were found to have inherent overcharge protection. For low-voltage lithium cells such as lithium/titanium disulfide, the survey identified a number of electrolyte additives that undergo oxidation above the charging potentials but below the solvent oxidation potential and can provide overcharge protec-

tion in these cells. The oxidized form of the additive then reacts with lithium to regenerate the original electrolyte additive. However, no suitable electrochemical method was identified for providing overcharge protection in lithium or lithium-ion cells that require charging to potentials above approx. 4 V.
DTIC
Sulfur Dioxides; Electric Batteries; Electrochemical Cells; Lithium

19990025645 University of Central Florida, Orlando, FL USA
Self-Guiding Effects in Gallium Arsenide Semiconductor Optical Amplifiers
Kutsche, Carl Alan, University of Central Florida, USA; Jan. 1998; 187p; In English
Report No.(s): AD-A359040; AFIT-FY99-22; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

The realization of all optical devices requires identification and characterization of materials possessing large nonlinearities and low loss. Although gallium arsenide aluminum gallium arsenide (GaAs-AlGaAs) quantum well structures have very large third order resonant nonlinearities just below the bandgap, the absorption in this region makes them unusable for all optical processing devices. Using these materials at below 1/2 of the bandgap reduces the losses, but also reduces the nonlinearity. In this research, we investigate a different method of accessing the nonlinearity. by fashioning GaAs-AlGaAs double heterostructure devices into semiconductor optical amplifiers, a strong positive nonlinearity correlated to the gain of the device was identified and characterized. This nonlinearity is all the more valuable as these devices can provide gain to the signal as opposed to loss thereby boosting the effective nonlinearity of the devices. The detriment in using this type of carrier induced effect is that the nonlinearity is not instantaneous and requires over 1 ps to stabilize. Standard interferometric techniques were used to characterize the nonlinearity in these forward biased devices. The resulting measurements when compared to Kerr nonlinearity of generic form n(sub r) = n(sub o) + n(sub 2)I, returned an effective nonlinear coefficient of refractive index n(sub 2) on the order of 5 x 10(exp -10) cu cm/W.
DTIC
Aluminum Gallium Arsenides; Semiconductor Devices; Semiconductors (Materials); Optical Equipment; Light Amplifiers

19990025646 Army Research Lab., Sensors and Electron Devices Directorate, Adelphi, MD USA
Effects of a Radome on a UWB Detection System, *Nov. 1996 - May 1997*
Litz, Marc, Army Research Lab., USA; del osario, Romeo D., Army Research Lab., USA; Leshick, Keith, Army Research Lab., USA; Sep. 1998; 21p; In English
Report No.(s): AD-A359045; ARL-SR-73; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We evaluated a radome housing an ultra-wideband (UWB) signal collection system, measuring the transmission loss and phase delay through the radome. The radome introduced losses of up to 3 dB within the normal operating range of the antennas. Phase differences due to the radome appeared to be linear and consistent with the delay expected from a uniformly layered material. We observed no unusual effects from the specially designed protective radome.
DTIC
Radomes; Antennas; Evaluation; Transmission Loss; Broadband

19990025654 State Univ. of New York, Dept. of Physics and Astronomy, Stony Brook, NY USA
Low-Temperature Superconductor Digital Electronics *Final Report, 15 Sep. 1995 - 14 Sep. 1998*
Likharev, Konstantin K.; Jan. 04, 1999; 16p; In English
Contract(s)/Grant(s): F49620-95-1-0415
Report No.(s): AD-A359322; AFRL-SR-BL-TR-99-0015; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This is the final technical report on the research project ”Advanced Superconductor Digital Electronics” (2nd stage of DoD’s University Research Initiative, multi-agency topic ”Low-Temperature Superconductor Digital Electronics”).
DTIC
Superconductors (Materials); Solid State Devices

19990025751 Princeton Univ., NJ USA
Novel Full Color Flat Panel Display Technology Employing High Performance, Crystalline Organic Semiconductor Light Emitting Diodes *Final Report, Jun. 1994 - Jun. 1997*
Forrest, Stephen R.; Thompson, Mark E.; Lam, Juan; May 1998; 46p; In English
Contract(s)/Grant(s): F33615-94-1-1414
Report No.(s): AD-A359013; AFRL-HE-WP-TR-1998-0098; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

During the course of this program, several breakthroughs in the development of full color flat panel displays based on organic light emitting devices (OLEDs) were made. In particular, we demonstrated the first transparent OLED, flexible OLED based on molecular organic materials, and full color stacked OLED. These three devices, along with several other similar structures, including high efficiency devices employing shaped substrates and inverted, integratable OLEDs, provide a range of tools which change the possibilities for realizing very high resolution, high efficiency, and light weight OLED based displays for a wide range of DOD and commercial applications. In other advances, we developed a model linking current transport and eletroluminescence in molecular OLEDs, and have worked closely with several industrial partners to rapidly transfer technology from the conceptual, laboratory phase into commercial applications.
DTIC
Flat Panel Displays; High Resolution; Light Emitting Diodes; Organic Materials; Organic Semiconductors; Semiconductor Diodes

19990025758 L and O Research and Development Corp., Wayne, PA USA
3-D Diamond MCM Technology Development Program ***Final Report, Oct. 1991 - Nov. 1998***
Schaefer, Dean A.; Nov. 30, 1998; 98p; In English
Contract(s)/Grant(s): MDA972-91-C-0035; DARPA ORDER-8153
Report No.(s): AD-A359076; TR-0002AL; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche
3-D Diamond MCMs is an enabling technology to support chip-to-chip and module-to-module high<densityconnectivity-andthemal management. The extremely high conductivity of diamond, coupled with its electrically insulating nature, makes it an ideal choice for solving 3-D packaging problems. The thermal conductivity is so high as to allow over 80 W/cu in of power dissipation to be extracted from a stack of diamond substrates by lateral thermal conduction techniques alone. Diamond laterally conducts the heat generated by the logic out of the ”battle zone” of the actively populated 3-D stack of MCMs. This frees the designer to fully utilize all of the space between boards to implement a high area density array of vertical z-axis interconnects between all adjacent boards in the stack to minimize interconnect delays. This report summarizes the design, fabrication, integration and testing of a Demonstration Test Bed that was utilized as a tool for testing and demonstrating the thermal management capability of diamond MCMs. A signal integrity analysis was also performed to illustrate the high speed signal viability through the z-axis 3-D interconnect structure itself. Supporting system design details, photographs of fabricated components and subsystems, and test results are provided.
DTIC
Chips; Conductive Heat Transfer; Diamonds; Fabrication; High Speed; Selection

19990025778 Army Research Lab., Sensors Directorate, Adelphi, MD USA
Positive Temperature Coefficient of Breakdown Voltage in 4H-SiC PN Junction Rectifiers
Neudeck, Philip G.; Fazi, Christian; Jan. 1998; 5p; In English; Prepared in cooperation with NASA Lewis Research Center, Cleveland, OH.
Report No.(s): AD-A359099; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
It has been suggested that once silicon carbide (SiC) technology overcomes some crystal growth obstades, superior SiC semiconductor devices will supplant silicon in many high power applications. However, a positive temperature coefficient of breakdown voltage, a feature crucial to realizing excellent power device reliability, has not been observed in 4H-SiC, which is presently the best-suited SiC polytype for power device implementation. This paper reports the first experimental measurements of stable positive temperature coefficient behavior observed in 4H-SiC pn junction rectifiers. This research indicates that robust 4H-SiC power devices with high breakdown reliability should be achievable after SiC foundries reduce material defects such as micropipes, dislocations, and deep-level impurities.
DTIC
Crystal Growth; Defects; Electric Potential; Foundries; P-N Junctions; Semiconductor Devices; Stability

19990025906 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA
Characteristic features of the exotic superconductors: A summary
Brandow, B., Department of Energy, USA; Sep. 30, 1997; 13p; In English; Spectroscopies of novel superconductors
Report No.(s): DE98-001526; LA-UR-97-3703; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The authors summarize the results of a comprehensive examination of the characteristic features of the exotic superconductors, the superconductors so-labelled by Uemura and co-workers. In both the electronic and the crystal- chemistry properties, they

find anomalous features which appear to be universal for these materials, as well as other features which are clearly not universal but common enough to be considered typical for these materials. Some implications of these anomalies are discussed.
NTIS
Superconductors (Materials); Crystals

19990025948 Naval Research Lab., Washington, DC USA
Achieving Reliable Information from Extensive Sensor Cluster Networks on Ships
Kant, Richard A.; Hubler, Graham K.; Dec. 31, 1998; 23p; In English
Report No.(s): AD-A358858; NRL/MR/6670--98-8331; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This report is the result of a study that seeks to provide guidelines for obtaining reliable information from a sensor network that frequently or continuously monitors the interior status of a ship. It compliments other reports in preparation from NRL. Approaches include built-in tests (BIT) and built-in calibration (BIC) but they have drawbacks. The primary finding and recommendation of this study is that redundancy is feasible and is the most cost effective route for achieving reliable sensor data.
DTIC
Calibrating; Cost Effectiveness; Redundancy

19990026037 Joint Publications Research Service, Arlington, VA USA
JPRS Report, Science & Technology, Central Eurasia: Engineering & Equipment
Oct. 26, 1992; 34p; In English
Report No.(s): AD-A358741; JPRS-UEQ-92-012; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This report contains information on the Central Eurasia's electronics and electrical engineering science and technology. Specific topics include: (1) broadcasting, consumer electronics; (2) antennas, propagation; (3) circuits, systems; (4) transportation; (5) industrial electronics, control instrumentation; (6) computers; (7) power engineering; (8) industrial applications; (9) quantum electronics, electrooptics; and (10) solid state circuits.
CASI
Russian Federation; Research and Development; Electrical Engineering; Electronics

19990026038 Joint Publications Research Service, Arlington, VA USA
JPRS Report, Science & Technology, Central Eurasia: Electronics & Electrical Engineering
Mar. 18, 1992; 17p; In English
Report No.(s): AD-A358738; JPRS-UEE-92-003; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This report contains information on the Central Eurasia's electronics and electrical engineering science and technology. Specific topics include: (1) broadcasting, consumer electronics; (2) antennas, propagation; (3) circuits, systems; (4) transportation; (5) industrial electronics, control instrumentation; (6) computers; (7) power engineering; (8) industrial applications; (9) quantum electronics, electrooptics; and (10) solid state circuits.
CASI
Russian Federation; Research and Development; Electrical Engineering; Electronics

19990026039 Joint Publications Research Service, Arlington, VA USA
JPRS Report, Science & Technology, Central Eurasia: Electronics & Electrical Engineering
Feb. 21, 1992; 16p; In English
Report No.(s): AD-A358726; JPRS-UEE-92-002; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This report contains translations/transcriptions of articles and/or broadcasts on electronics and electrical engineering in Eurasia. Specific topics include: (1) broadcasting, consumer electronics; (2) antennas, propagation; (3) circuits, systems; (4) transportation; (5) industrial electronics, control instrumentation; (6) computers; (7) power engineering; (8) industrial applications; (9) quantum electronics, electrooptics; and (10) solid state circuits.
CASI
Research and Development; Russian Federation; Electrical Engineering; Electronics

19990026040 Stanford Univ., Solid-state Electronics Lab., Stanford, CA USA
Novel Micromechanical Tunneling Structures for Sensor Applications
McCord, M. A., Stanford Univ., USA; Dana, A., Stanford Univ., USA; Pease, R. F., Stanford Univ., USA; Jan. 1998; 5p; In English
Contract(s)/Grant(s): DAAL01-9692-0001
Report No.(s): AD-A358681; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Electrostatically controlled micro-cantilevers with integrated tunnel junctions can form the basis of a number of interesting devices with sensor applications. Use of a tunnel junction provides an extremely sensitive way to sense the cantilever position. In its simplest form the device can be used as a high gain, extremely low power amplifier. If the cantilever were fabricated from a bimetallic strip, it becomes a temperature sensor suitable for use as an pixel element in an infrared focal plane array. Other potential applications include acoustic and seismic sensing. Preliminary cantilever fabrication results will be presented.
DTIC
Bimetals; Detection; Fabrication; Focal Plane Devices; High Gain; Infrared Radiation; Micromechanics

19990026091 Joint Publications Research Service, Arlington, VA USA
JPRS Report, Science & Technology, Central Eurasia: Electronics & Electrical Engineering
Feb. 03, 1992; 32p; In English
Report No.(s): AD-A358742; JPRS-UEE-92-001; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This report contains information on the Central Eurasia's electronics and electrical engineering science and technology. Specific topics include: (1) broadcasting, consumer electronics; (2) antennas, propagation; (3) circuits, systems; (4) transportation; (5) industrial electronics, control instrumentation; (6) computers; (7) power engineering; (8) industrial applications; (9) quantum electronics, electrooptics; and (10) solid state circuits.
CASI
Russian Federation; Research and Development; Electrical Engineering; Electronics

19990026092 Joint Publications Research Service, Arlington, VA USA
JPRS Report, Science & Technology, Central Eurasia: Engineering & Equipment
Dec. 31, 1992; 57p; In English
Report No.(s): AD-A358743; JPRS-UEQ-92-013; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
This report contains information on the Central Eurasia's engineering and equipment technology. Specific topics include: optics & high energy devices; nuclear energy; non-nuclear energy; and industrial technology, planning, & productivity.
CASI
Russian Federation; Research and Development; Energy Technology; Nuclear Energy; Optics

19990026102 Naval Postgraduate School, Dept. of Physics, Monterey, CA USA
Fiber Lattice Accumulator Design Considerations for Optical Sigma-Delta Digital Antennas
Bewley, Scott A.; Dec. 1998; 69p; In English
Report No.(s): AD-A359358; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
The ability to directly oversample and digitize microwave range signals at an antenna is not possible with current electronic technologies. The objective for this thesis was to design and computer model an optical sampling and digitization process using a mode-locked laser and fiber lattice accumulators. A novel fiber lattice accumulator design for integrated optical sigma-delta digital antenna technology is presented. The fiber lattice design uses phase modulation to produce the proper interference between input and recirculated/delayed optical pulses in order that they may coherently combine. In this manner, accumulation within the fiber lattice takes into account the sign of a sampled bipolar antenna signal. The fiber lattice performance is numerically evaluated within a first-order optical sigma-delta digital antenna phase coherent simulation. The initial computer simulations show promising results using lower frequency antenna signals to verify optical design feasibility and operation. Optical results closely matched all-electronic simulations. The error between the input antenna and output signals is quantified, and proves correct device performance. All results show the first-order optical sigma-delta does work and is ready for experimental construction. The significance of this device will be its usefulness in extending high resolution sigma-delta analog-to-digital conversion into the microwave signal bands.
DTIC
Analog to Digital Converters; Design Analysis; Digital Simulation; Electromagnetic Pulses; Microwave Frequencies

19990026108 Kansas Univ., Lawrence, KS USA
Digital Signal Processing Rapid Prototyping with Field Programmable Gate Arrays ***Final Report, Feb. 1995 - Feb. 1998***
Nalinimohan, Kambhammettu; Rao, Venkatesh; Prescott, Glenn E.; Dec. 1998; 104p; In English
Contract(s)/Grant(s): F30602-95-C-0214; AF Proj. 4519
Report No.(s): AD-A359520; AFRL-IF-RS-TR-1998-212; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
Until recently radio transmitters and receivers were almost exclusively implemented with analog electronic components. However, a new approach is now becoming popular -- one that employs digital electronics to implement most of the analog signal

processing functions in the radio. The evolution in radio system design is driven by the ever increasing speed and decreasing cost of microprocessors and high performance analog-to-digital (ADC) and digital-to-analog (DAC) converters. It is no longer uncommon to sample a received signal at the intermediate frequency (IF) stage and process the signal with numerical algorithms using specialized- digital signal processing (DSP) hardware. The DSP hardware performs a variety of operations on the signal including downconversion, demodulation, and filtering; all of which are inherently continuous-time (i.e., analog) processes. Modern field programmable gate arrays can implement functions beyond the capabilities of today's DSP micro-processors. In fact, they have the potential to provide performance increases of an order of magnitude or better over traditional DSP microprocessors, but with the same flexibility. These devices can provide the programmability of software, the high speed of hardware and can be reconfigured in-circuit with no physical change to the hardware. In fact, FPGAs are really "soft hardware, in that they are a good compromise between flexible all-software approaches which unfortunately limit throughput, and custom hardware implementations, which are more expensive and inflexible. FPGAs offer a powerful approach -- an architecture tailored to the specific application.
DTIC
Radio Transmitters; Signal Processing; Digital Systems; Gates (Circuits); Radio Equipment; Radio Receivers; Prototypes; Digital Electronics

19990026110 Purdue Univ., Dept. of Earth and Atmospheric Sciences, West Lafayette, IN USA
Dual-Use Smart Antenna Processing: Blind Adaptive Beamforming, GPS, and Vector Sensors ***Final Report, 1 Jul. 1995 - 31 May 1998***
Zoltowski, Michael D.; Aug. 31, 1998; 22p; In English
Contract(s)/Grant(s): F49620-95-1-0451
Report No.(s): AD-A359335; AFRL-SR-BL-TR-99-0022; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

There were numerous accomplishments in three areas: blind adaptive beamforming, adaptive null steering for GPS, and vector sensor processing. In the area of blind adaptive beamforming, an algorithm was developed for estimating the respective carrier and timing offset of each of a number of co-channel digital communication signals with linear modulation, along with an SINR maximizing beamforming weight vector for each source. In support of anti-jam protection for GPS, an algorithm was developed for canceling jammers AFTER de-spreading the GPS signal from a given satellite. This approach diminishes the data rate provided to the processor that adapts the beamforming, thereby allowing the use of a low-cost microprocessor. This also facilitates the use of the narrowband blind adaptive beamformer described above to cancel jammers. The algorithm was successfully demonstrated with experimental data from a prototype antenna array. The major development in the area of vector sensors was a closed-form algorithm for unambiguous estimation of the azimuth and elevation angle of each of a number of co-channel sources using a small array of vector sensors with large inter-vector sensor spacings for space diversity to combat fading. As listed in Section 3, this research has been extensively published in journals and presented at a number of high-profile conferences on signal processing and communications. This research has also been honored with a best paper award by Raytheon/E-Systems and a best dissertation award. Transitions of this research to Wright Laboratories at Wright-Patterson Air Force base is in progress.
DTIC
Global Positioning System; Microprocessors; Beamforming; Pulse Communication; Vector Processing (Computers)

19990026130 Department of Energy, Office of Energy Research, Washington, DC USA
Rack Protection Monitor: A Simple System
Orr, S., Department of Energy, USA; Dec. 31, 1997; 5p; In English
Report No.(s): DE98-051730; FNAL-TM-2034; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Rack Protection Monitor is a simple, fail-safe device to monitor smoke, temperature and ventilation sensors. It accepts inputs from redundant sensors and has a hardwired algorithm to prevent nuisance power trips due to random sensor failures. When a sensor is triggered the Rack Protection Monitor latches and annunicates the alarm. If another sensor is triggered, the Rack Protection Monitor locally shuts down the power to the relay rack and sends alarm to central control.
NTIS
Electronic Equipment; Fail-Safe Systems; Warning Systems; Temperature Sensors; Smoke; Remote Sensors

19990026153 Department of Defense, Washington, DC USA
Identifying high-level components in combinational circuits
Doom, T., Department of Defense, USA; White, J., Department of Defense, USA; Wojcik, A., Department of Defense, USA; Chisholm, G., Department of Defense, USA; Dec. 31, 1998; 6p; In English; VLSI
Report No.(s): DE98-057797; ANL/DIS/CP-95734; CONF-980251; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The problem of finding meaningful subcircuits in a logic layout appears in many contexts in computer-aided design. Existing techniques rely upon finding exact matchings of subcircuit structure within the layout. These syntactic techniques fail to identify functionally equivalent subcircuits that are differently implemented, optimized, or otherwise obfuscated. The authors present a mechanism for identifying functionally equivalent subcircuits that can overcome many of these limitations. Such semantic matching is particularly useful in the field of design recovery.
NTIS
Computer Aided Design; Equivalent Circuits; Logic Circuits

19990026195 Dirigo R and D, Inc., Brunswick, ME USA
Demonstration of the Production of 60 HZ AC Power Directly from High Frequency Alternators ***Final Report***
Tupper, Christopher N.; Sep. 1995; 65p; In English
Contract(s)/Grant(s): DAAB12-95-C-0011
Report No.(s): AD-A359482; DIRIGO/TR-95/01; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This document presents the results of a project to demonstrate the production of 60 Hz AC power directly from high frequency alternators. A technique of modulating the output of existing truck and automotive style DC alternators was developed to produce low voltage single phase 60 Hz rectified output. The load was connected to this source by a commutation circuit that switched polarity of the load at the zero voltage crossing of each half cycle, exciting the load with a sinusoidal waveform. Existing low voltage DC alternators exhibited very high core losses in the 60 Hz modulation of the magnetic field, but calculations show that this could be significantly reduced by use of laminated electrical steel for the entire magnetic circuit. Calculations show that high frequency alternators could be designed to produce 120 VAC directly with low core losses, making this a practical method of generating 60 Hz AC power.
DTIC
AC Generators; Alternating Current; Automobiles

19990026210 Department of Energy, Office of Energy Research, Washington, DC USA
Klystron: A microwave source of surprising range and endurance
Caryotakis, G., Department of Energy, USA; Apr. 30, 1998; 14p; In English; 39th, Unknown; Sponsored by American Physical Society, USA
Report No.(s): DE98-059183; SLAC-PUB-7731-Rev; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This year marks the 60th anniversary of the birth of the klystron at Stanford University. The tube was the first practical source of microwaves and its invention initiated a search for increasingly more powerful sources, which continues to this day. This paper reviews the scientific uses of the klystron and outlines its operating principles. The history of the device is traced, from its scientific beginnings, to its role in World War II and the Cold War, and to its current resurgence as the key component in a major accelerator project. Finally, the paper describes the development of a modular klystron, which may someday power future accelerators at millimeter wavelengths.
NTIS
Klystrons; Microwaves

19990026236 Aeroflex Labs., Inc., Plainview, NY USA
Microelectronics Instrument Products Shock and Vibration Electro-Optics, Section B, Acceptance Data Package
Jul. 20, 1995; 174p; In English
Contract(s)/Grant(s): NAS8-39409; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The motor/encoder (henceforth referred to as the UUT) test sequence began with a baseline functional evaluation, which demonstrated that the motor satisfied the operating torque, cogging torque, winding resistance, and mechanical requirements of SOW. In addition, the encoder electrical requirements were verified, as well as the alignment of the encoder outputs relative to the motor shaft position. There were no discrepancies observed in this portion of the test. The UUT was then exposed to a number of environments, including thermal vacuum, thermal cycling, random and sine vibration, and mechanical shock. During the thermal environments, the performance of the UUT under load was verified at specified points in the cycles, as described in ATP 20049. In addition, the UUT was bench tested between the two thermal environments. No anomalies were observed during the thermal tests. The vibration and shock tests were performed by East-West Technology Corporation, West Babylon, New York. The UUT was delivered to the lab in a sealed vibration fixture in order to maintain the cleanliness levels required by the SOW. In addition, a three

ounce load was attached to the motor shaft. The attachment method of this load caused damage to the shaft and bearing during random vibration of S/N 0003 on April 28, 1995, and is described further in NCR 00168.
Derived from text
Microelectronics; Electronic Equipment; Vibration Tests; Shock Tests; Electro-Optics; Shafts (Machine Elements); Mechanical Shock

19990026254 Aeroflex Labs., Inc., Farmingdale, NY USA
Microelectronics Instrument Products Shock and Vibration Electro-Optics, Section D, Strength Analysis
Mar. 16, 1994; 34p; In English
Contract(s)/Grant(s): NAS8-39409; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The strength analysis report for FRR shall include only revisions to update the strength analysis reports for the flight design configuration. Since there have been no revisions to the design configuration since the PDR and the CDR this report shall consist of re-submitting the analysis previously performed. In addition the motors have been subjected to Sine vibration, Random vibration, and shock per the SXI specification. Both motor/encoders have passed all three tests. There was no evidence of damage to the motor/encoder and the motor/encoder performed as required by the Acceptance test procedure. No degradation was seen between the before and after performance tests. The testing verified the analysis that there were adequate mf@ty margins with regard to structural integrity. Separate reports are available from the test facility and are apart of the FRR submittal.
Author
Microelectronics; Electro-Optics; Structural Failure; Random Vibration; Performance Tests; Acceptability; Mechanical Properties

19990026280 Department of Energy, Office of Energy Research, Washington, DC USA
Porosity in collapsible Ball Grid Array solder joints
Gonzalez, C. A., Department of Energy, USA; May 31, 1998; 70p; In English
Report No.(s): DE98-059380; LBNL-42052; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Ball Grid Array (BGA) technology has taken off in recent years due to the increased need for high interconnect density. Opposite to all the advantages BGA packages offer, porosity in collapsible BGA solder joints is often a major concern in the reliability of such packages. The effect of pores on the strength of collapsible BGA solder-joints was studied by manufacturing samples with different degrees of porosity and testing them under a shear load. It was found that the shear strength of the solder joints decreased in a linear fashion with increasing porosity. Failure occurred by internal necking of the interpore matrix. It was confirmed that entrapment of flux residues leads to porosity by manufacturing fluxless samples in a specially made furnace, and comparing them with samples assembled using flux. Also, contamination of Au electrodeposits (in substrate metallization) was determined to cause significant porosity. It was found that hard-Au (Co hardened Au) electrodeposits produce high degrees of porosity even in the absence of flux. Finally, increasing the time the solder spends in the molten state was proven to successfully decrease porosity.
NTIS
Soldered Joints; Electronic Packaging; Porosity; Expandable Structures; Manufacturing; Electrodeposition

19990026287 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Total energy cycle emissions and energy use of electric vehicles
Singh, M., Department of Energy, USA; Dec. 31, 1997; 14p; In English; 14th; Electric vehicle
Report No.(s): DE98-057790; ANL/ES/CP-95869-VUGRAPHS; CONF-971212; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The purpose of this project is to provide estimates of changes in life cycle energy use and emissions that would occur with the introduction of EVs. The topics covered include a synopsis of the methodology used in the project, stages in the EV and conventional vehicle energy cycles, characterization of EVs by type and driving cycle, load analysis and capacity of the electric utility, analysis of the materials used for vehicle and battery, description of the total energy cycle analysis model, energy cycle primary energy resource consumption, greenhouse gas emissions, energy cycle emissions, and conclusions.
NTIS
Electric Motor Vehicles; Energy Consumption; Cycles; Exhaust Emission; Life (Durability)

19990026290 Vixel, Inc., Broomfield, CO USA

Smart Pixels for Optical Processing ***Final Report, Aug. 1992 - Jul. 1996***

Olbright, Gregory; Bryan, Robert; Lewis, David; Wasserbauer, John; Dec. 1998; 38p; In English

Contract(s)/Grant(s): F30602-92-C-0091; DARPA ORDER-8680; AF Proj. H680

Report No.(s): AD-A359700; AFRL-SN-RS-TR-1998-222; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This work explored the integration of optoelectronic components with traditional electronic GaAs device technologies. The goal was to realize highly functional optoelectronic integrated circuits (OEICs). The intent is to use OEICs to increase performance for demanding military applications such as wideband interconnects, computing, neural networks, pattern recognition, and communications. This program consisted of three phases of work. First Heterojunction Bipolar Transistors (HBTs) were integrated with Vertical-Cavity Surface Emitting Lasers (VCELS). Devices were successfully fabricated and demonstrated. Second, improved HBT/VCSEL devices were designed and fabricated. Third, PIN detector diodes were integrated with VCSELs for application as an optical interconnect element or as an optical processing element (smart pixel). A 2 x 16 VCSEL/PIN array was fabricated and characterized. Recommendations for device improvements and future work are provided.

DTIC

Electro-Optics; Integrated Circuits; Surface Emitting Lasers; Heterojunction Devices; Gallium Arsenides; Fabrication; Bipolar Transistors; Junction Diodes; P-I-N Junctions; Pixels

19990026407 Department of Energy, Office of Financial Management and Controller, Washington, DC USA

Dielectrics for GaN based MIS-diodes

Ren, F., Department of Energy, USA; Abernathy, C. R., Department of Energy, USA; MacKenzie, J. D., Department of Energy, USA; Feb. 28, 1998; 6p; In English; Sponsored by Materials Research Society, USA

Report No.(s): DE98-004137; SAND-98-0524C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

GaN MIS diodes were demonstrated utilizing AlN and Ga2O3Gd2O3 as insulators. A 345 (angstrom) of AlN was grown on the MOCVD grown n-GaN in a MOMBE system using trimethylamine alane as Al precursor and nitrogen generated from a wavemat ECR N2 plasma. For the Ga2O3Gd2O3 growth, a multi MBE chamber was used and a 195 (angstrom) oxide is E- beam evaporated from a single crystal source of Ga5Gd3O12. The forward breakdown voltage of AlN and Ga2O3Gd2O3 diodes are 5 V and 6 V, respectively, which are significantly improved from (approximately) 1.2 V of schottky contact. From the C-V measurements, both kinds of diodes showed good charge modulation from accumulation to depletion at different frequencies. The insulator GaN interface roughness and the thickness of the insulator were measured with x-ray reflectivity.

NTIS

Semiconductor Diodes; Gallium Nitrides; Aluminum Nitrides; Diodes; Cyclotron Resonance

19990026409 Department of Energy, Washington, DC USA

Development of InAsSb-based light emitting diodes for chemical sensing systems

Allerman, A. A., Department of Energy, USA; Kurtz, S. R., Department of Energy, USA; Biefeld, R. M., Department of Energy, USA; Baucom, K. C., Department of Energy, USA; Burkhart, J. H., Department of Energy, USA; Feb. 28, 1998; 10p; In English; BIOS 1998: Biomedical optics

Report No.(s): DE98-004134; SAND-98-0459C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Mid-infrared (3--6 (micro)m) LED's are being developed for use in chemical sensor systems. As rich, InAsSb heterostructures are particularly suited for optical emitters in the mid-infrared region. The authors are investigating both InAsSb-InAs multiple quantum well (MQW) and InAsSb-InAsP strained layer superlattice (SLS) structures for use as the active region for light emitting diodes (LED's). The addition of phosphorus to the InAs barriers increases the light and heavy hole splitting and hence reduces non-radiative Auger recombination and provides for better electron and hole confinement in the InAsSb quantum well. Low temperature (< 20 K) photoluminescence (PL) emission from MQW structures is observed between 3.2 to 6.0 (micro)m for InAsSb wells between 70 to 100 angstrom and antimony mole fractions between 0.04 to 0.18. Room temperature PL has been observed to 6.4 (micro)m in MQW structures. The additional confinement by InAsP barriers results in low temperature PL being observed over a narrower range (3.2 to 5.0 (micro)m) for the similar well thicknesses with antimony mole fractions between 0.10 to 0.24. Room temperature photoluminescence was observed to 5.8 (micro)m in SLS structures. The addition of a p-AlAsSb layer between the n-type active region (MQW or SLS) and a p-GaAsSb contact layer improves electron confinement of the active region and increases output power by a factor of 4. Simple LED emitters have been fabricated which exhibit an average power at room temperature of > 100 (micro)W at 4.0 (micro)m for SLS active regions. These LED's have been used to

detect CO(sub 2) concentrations down to 24 ppm in a first generation, non-cryogenic sensor system. They will report on the development of novel LED device designs that are expected to lead to further improvements in output power.
NTIS
Indium Arsenides; Light Emitting Diodes; Infrared Radiation

19990026448 Department of the Navy, Washington, DC USA
Miniature Hydrostat Fabricated Using Multiple Microelectromechanical Processes
Last, Howard R., Inventor; Fan, Lawrence C., Inventor; Balestrieri, Ralph E., Inventor; Garvick, Donald R., Inventor; Wood, Robert L., Inventor; Oct. 20, 1998; 8p; In English; Supersedes US-Patent-Appl-SN-840780
Patent Info.: Filed 16 Apr. 97,; US-Patent-Appl-SN-840,780; US-Patent-5,824,910
Report No.(s): AD-D019167; No Copyright; Avail: US Patent and Trademark Office, Microfiche

An improved hydrostat constructed on a silicon wafer by microfabrication methods similar to those used for integrated circuits and other devices. A thin section of the wafer acts as a diaphragm, responsive to pressure of ambient water. A lever arm is affixed at its first end to one point on the surface of the wafer and extends over the diaphragm, so arranged that the lever arm will be forced away from the wafer when pressure is applied to the diaphragm. The second end of the lever arm is moved by the diaphragm so that it moves further from the wafer, by a factor of the mechanical advantage of the lever. When the second end moves away from the wafer, it mechanically releases a lock, allowing an ordnance device to which the hydrostat is attached to arm.
DTIC
Microelectromechanical Systems; Silicon

19990026454 Department of the Navy, Washington, DC USA
Electronic Devices With InAlAsSb/AlSb Barrier
Boos, John B., Inventor; Kruppa, Walter, Inventor; Park, Doewon, Inventor; Bennett, Brian R., Inventor; Aug. 25, 1998; 8p; In English; Supersedes US-Patent-Appl-SN-848203, AD-D018667.
Patent Info.: Filed 29 Apr. 97,; US-Patent-Appl-SN-848,203; US-Patent-5,798,540
Report No.(s): AD-D019215; No Copyright; Avail: US Patent and Trademark Office, Microfiche

An electronic device characterized by a GaAs substrate and a base disposed on the substrate the base comprising InAs channel layer, AlSb layer above the channel layer In(x)Al(1-x)As(y)Sb(1-y) layer containing at least In, Al, and As disposed above the AlSb channel layer. InAs cap layer disposed above and in contact with the In(x)Al(1-x)As(y)Sb(1-y)layer disposed below the InAs channel layer and in contact with the substrate p(+) GaSb layer disposed within the AlSb layer. Schottky gate with a pad disposed on and in contact with the In(x)Al(1-x)As(y)Sb(1-y) layer at least one ohmic contact disposed on the InAs cap layer and a trench extending through the base to the substrate isolating the gate bonding pad from the device and providing a gate air bridge which prevents contact between the gate and the InAs layer. The gate air bridge fabrication is accomplished by a liquid etchant containing more than half on volume basis of concentrated lactic acid or acetic acid with remainder hydrogen peroxide and concentrated hydrofluoric acid. The etchant attacks InAs, In(x)Al(1-x)As(y)Sb(1-y), and GaSb but does not attack GaAs and Au-based alloys.
DTIC
Electronic Equipment; Etching; Etchants; Indium Antimonides; Gallium Arsenides

19990026455 Department of the Navy, Washington, DC USA
High Temperature Mercury-Containing Superconductors and Method of Making the Same
Toth, Louis E., Inventor; Lechter, William, Inventor; Skelton, Earl F., Inventor; Osofsky, Michael, Inventor; Jul. 07, 1998; 5p; In English; Supersedes US-Patent-Appl-SN-430955, AD-D017525.
Patent Info.: Filed 28 Apr. 95,; US-Patent-Appl-SN-430,955; US-Patent-5,776,861
Report No.(s): AD-D019216; No Copyright; Avail: US Patent and Trademark Office, Microfiche

Hg.Tl-based superconductors are produced by HIPping. A new superconducting phase having a double (Hg.Tl)-layer and the nomial composition: Hg(1-x)Tl(x)2Ba(1-a)SR(a)2Ca(1-b)Y(b)2Cu3O(z) where 0DTIC
High Temperature Superconductors; Hot Pressing; Superconductors (Materials)

19990026518 Department of the Navy, Washington, DC USA
Wide Beam Array with Sharp Cutoff
Zehner, William J., Inventor; Jul. 14, 1998; 5p; In English; Supersedes US-Patent-Appl-SN-228848
Patent Info.: Filed 28 May 96,; US-Patent-Appl-SN-668,456; US-Patent-5,781,509
Report No.(s): AD-D019228; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A transducer array is constructed from a constant arc length portion of a right circular cylindrical shell of piezoelectric transduction material. The constant arc length Portion is segmented evenly along the length thereof to define a plurality of transducers. The transducers can be in the free field or mounted on a planar baffle.
DTIC
Piezoelectric Transducers; Piezoelectricity; Genetics; Transducers

19990026521 Department of the Navy, Washington, DC USA
Sense Amplifier Control System for Ferroelectric Memories
Schwee, Leonard J., Inventor; Aug. 11, 1998; 8p; In English; Supersedes US-Patent-Appl-SN-733455, AD-D018861.
Patent Info.: Filed 18 Oct. 96,; US-Patent-5,793,667; US-Patent-Appl-SN-733,455
Report No.(s): AD-D019233; No Copyright; Avail: US Patent and Trademark Office, Microfiche
Different sequences of pulses applied to three terminals of a sense amplifier section in timed relation to address pulses applied to a word line of a ferroelectric memory cell, controls detection and transfer of data with respect to a selected bit line to which the sense amplifier section is connected for rapid reset following data transfer without any precharge.
DTIC
Computer Storage Devices; Memory (Computers); Ferroelectric Materials

19990026523 Department of the Navy, Washington, DC USA
Apparatus for a Testing System with a Plurality of First Connection Having a Structural Characteristic and a Plurality of Second Connection Having a Different Structural Characteristic Than the First Connection
Nguyen, John T., Inventor; Aug. 04, 1998; 12p; In English; Supersedes US-Patent-Appl-SN-682902, AD-D018517.
Patent Info.: Filed 24 Jun. 96,; US-Patent-5,790,896; US-Patent-Appl-SN-682,902
Report No.(s): AD-D019236; No Copyright; Avail: US Patent and Trademark Office, Microfiche
An input/output module in a system for testing the functionality of an electronic system. The input/output module includes a plurality of input connections for receiving signals from the electronic system and a number of output :1 connectors with different structural characteristics adapted for mating with plugs of correspondingly different structural characteristics to direct signals to another component of the testing system. For example the input/output module can include a plurality of BNC type plugs for signals of a first type and TNC type plugs for signals of a second type. This arrangement inhibits unintended cross connections between specific output connectors.
DTIC
Modules; Connectors; Structural Design; Bonding

19990026561 NASA Goddard Space Flight Center, Greenbelt, MD USA
An Adaptable Power System with Software Control Algorithm
Castell, Karen, NASA Goddard Space Flight Center, USA; Bay, Mike, NASA Goddard Space Flight Center, USA; Hernandez-Pellerano, Amri, NASA Goddard Space Flight Center, USA; Ha, Kong, NASA Goddard Space Flight Center, USA; 1998; 1p; In English; 5th; European Space Power, 21-25 Sep. 1998, Tarragone, Spain; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only
A low cost, flexible and modular spacecraft power system design was developed in response to a call for an architecture that could accommodate multiple missions in the small to medium load range. Three upcoming satellites will use this design, with one launch date in 1999 and two in the year 2000. The design consists of modular hardware that can be scaled up or down, without additional cost, to suit missions in the 200 to 600 Watt orbital average load range. The design will be applied to satellite orbits that are circular, polar elliptical and a libration point orbit. Mission unique adaptations are accomplished in software and firmware. In designing this advanced, adaptable power system, the major goals were reduction in weight volume and cost. This power system design represents reductions in weight of 78 percent, volume of 86 percent and cost of 65 percent from previous comparable systems. The efforts to miniaturize the electronics without sacrificing performance has created streamlined power electronics with control functions residing in the system microprocessor. The power system design can handle any battery size up to 50 Amp-hour and any battery technology. The three current implementations will use both nickel cadmium and nickel hydrogen batteries ranging in size from 21 to 50 Amp-hours. Multiple batteries can be used by adding another battery module. Any solar cell technology can be used and various array layouts can be incorporated with no change in Power System Electronics (PSE) hardware. Other features of the design are the standardized interfaces between cards and subsystems and immunity to radiation effects up to 30 krad Total Ionizing Dose (TID) and 35 Mev/cm(exp 2)-kg for Single Event Effects (SEE). The control algorithm for the power system resides in a radiation-hardened microprocessor. A table driven software design allows for flexibility in mission specific requirements. by storing critical power system constants in memory, modifying the system code for other programs is simple.

These constants can be altered also by ground command, or in response to an anomolous event. All critical power system functions have backup hardware functions to prevent a software or computer glitch from propagating. A number of battery charge control schemes can be implemented by selecting the proper control terms in the code. The architecture allows the design engineer to tune the system response to various system components and anticipated load profiles without costly alterations. A design trade was made with the size, weight and power dissipation of the electronics versus the performance of the power bus to load variations. Linear, fine control is maintained with a streamlined electronics design. This paper describes the hardware design as well as the software control algorithm. The challenges of closing the system control loop digitally is discussed. Control loop margin and power system performance is presented. Lab measurements are shown and compared to the system response of a hardware model running actual flight software.
Author
Electric Batteries; Nickel Cadmium Batteries; Spacecraft Power Supplies; Algorithms; Computer Systems Programs; Systems Engineering; Solar Cells; Nickel Hydrogen Batteries

19990026592 Department of Energy, Assistant Secretary for Human Resources and Administration, Washington, DC USA
High performance low cost interconnections for flip chip attachment with electrically conductive adhesive ***Final Report***
Dec. 31, 1998; 125p; In English
Report No.(s): DE98-005206; DOE/AL/98817-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
This final report is a compilation of final reports from each of the groups participating in the program. The main three groups involved in this effort are the Thomas J. Watson Research Center of IBM Corporation in Yorktown Heights, New York, Assembly Process Design of IBM Corporation in Endicott, New York, and SMT Laboratory of Universal Instruments Corporation in Binghamton, New York. The group at the research center focused on the conductive adhesive materials development and characterization. The group in process development focused on processing of the Polymer-Metal-Solvent Paste (PMSP) to form conductive adhesive bumps, formation of the Polymer-Metal Composite (PMC) on semiconductor devices and study of the bonding process to circuitized organic carriers, and the long term durability and reliability of joints formed using the process. The group at Universal Instruments focused on development of an equipment set and bonding parameters for the equipment to produce bond assembly tooling. Reports of each of these individual groups are presented here reviewing their technical efforts and achievements.
NTIS
Adhesives; Semiconductor Devices; Low Cost; Performance Prediction; Electrical Resistivity; Reliability

19990026626 Department of the Navy, Washington, DC USA
Data Multiplexing Node for Line Array
Habboosh, Amir W., Inventor; Reid, Robert J., Inventor; Jette, Steven D., Inventor; Jul. 28, 1998; 10p; In English
Patent Info.: Filed 5 Sep. 96,; US-Patent-Appl-SN-706590; US-Patent-5,786,919
Report No.(s): AD-D019189; No Copyright; Avail: US Patent and Trademark Office, Microfiche
A multiplexing node is associated with each analog sensor of a line array. Each multiplexing node has an amplifier/filter section coupled to its associated analog sensor for amplifying and shaping a signal generated by the sensor. An AID converter then samples the signal. A receiver is coupled to a previous one of the multiplexing nodes for receiving scrambled data and clock information in serial fashion from the previous node. A descrambler is coupled to the receiver to separate the data from the clock. A processor is coupled to the AID converter and the descrambler. The processor time division multiplexes the data and clock from the previous node with the sampled signal from the AID converter. The processor scrambles the so multiplexed data, clock and sampled signal. A transmitter is coupled to the processor to transmit the scrambled data clock and sampled signal in serial fashion over a single data line.
DTIC
Multiplexing; Amplification; Data Transmission

19990026628 Department of the Navy, Washington, DC USA
Method of Forming an Interband Lateral Resonant Tunneling Transistor
Meyer, Jerry R., Inventor; Hoffman, Craig A., Inventor; Bartoli, Filbert J., Jr, Inventor; Sep. 08, 1998; 12p; In English
Patent Info.: Filed 19 Jun. 96,; US-Patent-Appl-SN-665,931; US-Patent-5,804,475
Report No.(s): AD-D019193; No Copyright; Avail: US Patent and Trademark Office, Microfiche
This invention describes a nanometer scale interband lateral resonant tunneling transistor, and the method for producing the same, with lateral geometry, good fanout properties and suitable for incorporation into large-scale integrated circuits. The transistor is of a single gate design and operation is based on resonant tunneling processes in narrow-gap nanostructures which are highly

responsive to quantum phenomena. Such quantum-effect devices can have very high density, operate at much higher temperatures and are capable of driving other devices.
DTIC
Transistors; Quantum Wells; Nanostructures (Devices)

19990026636 Department of the Navy, Washington, DC USA
Distributed Quantization Noise Transmission Zeros in Cascaded Sigma-Delta Modulators
Harris, Frederick J., Inventor; Caulfield, Robert W., Inventor; McKnight, William H., Inventor; Jun. 02, 1998; 8p; In English; Supersedes US-Patent-Appl-SN-381665
Patent Info.: Filed 31 Jan. 95,; US-Patent-5,760,722; US-Patent-Appl-SN-381,665
Report No.(s): AD-D019255; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A series of sigma-delta modulators are connected in a cascaded architecture. Each sigma-delta modulator has a noise transfer function that defines a unique set of quantization noise transmission zeros. A circuit is coupled to the cascaded architecture and has a signal transfer function that is an approximation of the noise transfer function of a first sigma-delta modulator in the series of sigma-delta modulators.
DTIC
Analog to Digital Converters; Digital to Analog Converters; Signal Processing; Transfer Functions

19990026637 Department of the Navy, Washington, DC USA
Digital Mixing to Baseband Decimation Filter
Caulfield, Robert W., Inventor; Harris, Frederick J., Inventor; McKnight, William H., Inventor; May 26, 1998; 7p; In English; Supersedes US-Patent-Appl-SN-413331
Patent Info.: Filed 30 Mar. 95,; US-Patent-5,757,867; US-Patent-Appl-SN-413,331
Report No.(s): AD-D019256; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A digital mixing to baseband decimation filter includes a mixer section and a low-pass filter section. The mixer section generates in-phase and quadrature signal components at baseband from low-resolution, high-rate digital data lying within a signal passband offset from baseband. The low-pass filter section transforms an incoming data stream to high-resolution, low-rate digital data. The mixer section can precede or follow the filter section.
DTIC
Signal Processing; Analog to Digital Converters; Low Pass Filters; Data Flow Analysis; Digital Data

19990026645 NASA Goddard Space Flight Center, Greenbelt, MD USA
Electrical and Thermal Characteristics of Lithium-Ion Cells
Vaidyanathan, Hari, Communications Satellite Corp., USA; Rao, Gopalakrishna, NASA Goddard Space Flight Center, USA; 1999; 16p; In English; Applications and Advances, 12-15, Jan. 1999, Long Beach, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The 18650 type lithium ion cells are characterized by a cell resistance of 130 m Omega, capacity of 1.27 Ah at 25C, and a mid-discharge voltage of 3.6 V. The capacity loss in the 72-hour stand test was 3.39 percent. The heat dissipation properties were determined by a radiative calorimeter. During charge, initial endothermic cooling and subsequent exothermic cooling beyond 55 percent state-of-charge were observed. At C/2 rate of discharge (which is considered medium rate), the heat dissipated was 17 mW/cc. The heat dissipation profile during discharge is also unique in the presence of a minimum that is different from that observed for Ni-Cd, Ni-MH, and Ni-H2 cells.
Author
Electric Potential; Lithium; Metal Ions; Electric Batteries; Electrical Resistance; Charge Efficiency

19990026656 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Status of shipping provisions for large lithium batteries
Henriksen, G. L., Department of Energy, USA; Jan. 31, 1998; 10p; In English; 15th; Primary and Secondary Batteries, USA
Report No.(s): DE98-057811; ANL/CMT/CP-95786; CONF-980327; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In 1990, the Electric and Hybrid Propulsion Division of the US Department of Energy (DOE) established its ad hoc Advanced Battery Readiness Working Group to identify regulatory barriers to the commercialization of advanced electric vehicle (EV) battery technologies and to facilitate the removal of these barriers. As one of three sub-working groups, the Shipping Sub-working Group (SSWG) was formed to address regulatory issues associated with the domestic and international transport of new battery

technologies under development for EV and hybrid electric vehicle (HEV) applications. The SSWG is currently working with DOT on a proposal, which is intended for submission and consideration at the July 1998 meeting of the UN Sub-Committee of Experts. It is their intent to secure full support for the revised proposal from both the German and French delegations prior to its submission. It is critical to obtain UN Sub-Committee approval in July 1998, so that the DOT proposal can be considered and approved by the UN Committee of Experts at their meeting in December 1998. The UN Committee of Experts meets only on even numbered years, so failure to secure their approval in December 1998 will cause a two-year delay in implementing international regulations for large EV and HEV lithium-ion and lithium-polymer batteries. Details of the DOT proposal are provided in this paper, including provisions that would relax the lithium and lithium-alloy mass restrictions in a general way, thereby providing a measure of relief for small cells and batteries.
NTIS
Electric Batteries; Lithium; Electric Motor Vehicles

19990026660 Department of Energy, Washington, DC USA
Nano-structure multilayer technology fabrication of high energy density capacitors for the power electronic building book
Barbee, T. W., Department of Energy, USA; Johnson, G. W., Department of Energy, USA; Wagner, A. V., Department of Energy, USA; Oct. 21, 1997; 12p; In English; Power Electronics Applications, USA
Report No.(s): DE98-051162; UCRL-JC-128759; CONF-971188; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Commercially available capacitors do not meet the specifications of the Power Electronic Building Block (PEBB) concept. We have applied our propriety nanostructure multilayer materials technology to the fabrication of high density capacitors designed to remove this impediment to PEBB progress. Our nanostructure multilayer capacitors will also be enabling technology in many industrial and military applications. Examples include transient suppression (snubber capacitors), resonant circuits, and DC filtering in PEBB modules. Additionally, weapon applications require compact energy storage for detonators and pulsed-power systems. Commercial applications run the gamut from computers to lighting to communications. Steady progress over the last five years has brought us to the threshold of commercial manufacturability. We have demonstrated a working dielectric energy density of > 11 J/cu cm in 20 nF devices designed for 1 kV operation.
NTIS
Capacitors; Fabrication; Technology Assessment; Energy Storage; Flux Density

19990026711 Institute of Environmental Sciences, Energy Research and Process Innovation TNO, Apeldoorn, Netherlands
The Nickel-Metal Hydride Battery: State of the Art *Interim Report De Nikkel-Metaalhydride Batterij Stand van de Techniek*
terVeen, W. R., Institute of Environmental Sciences, Energy Research and Process Innovation TNO, Netherlands; Dec. 23, 1997; 41p; In Dutch
Contract(s)/Grant(s): A94/KM/132
Report No.(s): TNO-MEP-R97/411; Copyright; Avail: Issuing Activity; US Sales Only, Hardcopy, Microfiche

Within the scope of the Royal Netherlands Navy work on the development of the All Electric Ship (AES) concept, a study has been done on the development status of the NiMH system and the current availability of EV batteries by a number of battery manufacturers. The main difference between the NiMH battery and the NiCd battery is the energy storage in the negative electrode (NiMH battery: hydrogen atoms; NiCd battery: cadmium). Because of the equal principles of these batteries and the near equal voltages (NiMH: 1.25 V; NiCd: 1.3 V), both batteries are interchangeable. The rate of self discharge of both batteries is equal. Advantages of the NiMH battery are a higher discharge capacity (30 - 50%) and the fact that no hazardous Cd metal is being used. Therefore the NiMH battery is commonly seen as the successor of the NiCd battery. of the contacted battery manufacturers, only DAUG, GM Ovonic and Varta have EV batteries currently (end of 1997) available. Costs however are high at this moment (3000 - 5000 US$/kWh) and delivery times are long (8 - 15 weeks) due to low production rates. In 1997 a NiMH EV battery has been selected and ordered for preliminary experimental testing. Based on the test results a decision will be made (1998) if the NiMH battery is suited for application aboard ships and/or sub-marines.
Author
Electric Batteries; Nickel Compounds; Nickel Cadmium Batteries; Technological Forecasting

19990026724 Department of the Navy, Washington, DC USA
System Level Aid for Troubleshooting (SLAT)
Laureanno, Thomas, Inventor; Sep. 22, 1998; 12p; In English; Supersedes US-Patent-Appl-SN-570466, AD-D017898
Patent Info.: Filed 9 Nov. 95,; US-Patent-Appl-SN-570,466; US-Patent-5,812,758
Report No.(s): AD-D019175; No Copyright; Avail: US Patent and Trademark Office, Microfiche

This invention relates generally to a method and apparatus for isolating and analyzing faults in a complex system which is represented by a network comprising a plurality of nodes interconnected by links defining the flow among nodes corresponding to flows in the complex system. The complex system is stored as a database internal to the apparatus and represents a physical system under test. The apparatus localizes faults in the system by utilizing data structure search methods invoked by the operator successively passing and/or failing system nodes based on observed system status and technical information provided by the apparatus.
DTIC
Computer Programs; Data Structures; Complex Systems

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FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling. For related information see also 02 Aerodynamics and 77 Thermodynamics and Statistical Physics.

19990025211 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China
Fundamental and Subharmonic Instability Modes' Interaction in an Acoustically Controlled Elliptic Jet
Lin, Yuan-Tang, Feng Chia Univ., Taiwan, Province of China; Chang, Yi-Lin, Feng Chia Univ., Taiwan, Province of China; Journal of the Chinese Institute of Engineers: Transactions of the Chinese Institute of Engineers, Series A; January 1998; ISSN 0253-3839; Volume 21, No. 1, pp. 93-100; In English
Contract(s)/Grant(s): NSC-84-2212-E-035-001; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
The interaction of the fundamental and the subharmonic instability modes of an elliptic jet under excitations are investigated experimentally in this paper. Results indicated that the fundamental instability mode f(sub 0) saturated in the major axis location is almost the same as the subharmonic instability mode f(sub 0)/2 saturated in the minor axis. These two instability modes interact nonlinearly to produce the sum- and the difference-modes. The newly produced instability modes grow and subsequently interact with other instability modes to produce other sum- and difference-modes. A comb-like spectrum resulted from the nonlinear interaction during the evolution process in the free shear layer of the elliptic jet flow.
Author
Jet Flow; Shear Layers; Acoustic Nozzles; Unsteady Aerodynamics; Frequencies; Unsteady Flow

19990025274 Arizona State Univ., Dept. of Mechanical and Aerospace Engineering, Tempe, AZ USA
Influence of High-Amplitude Noise on Boundary-Layer Transition to Turbulence ***Final Report***
Saric, William S.; Dec. 1998; 26p; In English
Contract(s)/Grant(s): F49620-96-1-0369
Report No.(s): AD-A359230; AFRL-SR-BL-TR-99-0008; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This work completes a series of detailed experiments of boundary layers undergoing transition to turbulence with the major effort directed toward the most important issue facing the understanding of fundamental causes of transition, i.e., the receptivity to freestream disturbances. This problem is reviewed in detail by Saric et al. (1994). The present effort concentrates on leading-edge receptivity and receptivity of two-dimensional roughness. The effects of large-amplitude freestream noise is considered with the effort directed toward determining the limits of linear receptivity. Single-frequency and broad-band sound waves are used along with 2-D roughness elements to determine how the unstable waves are initiated. New data are presented on leading edge-receptivity that clarify some difficulties with previous experimental work. Comparisons with recent DNS are excellent. Data are also presented for nonlinear receptivity of 2-D roughness elements. It is shown that there is little difference between the single-frequency excitation and white noise in that the response is still keenly triggered by the amplitude of the individual mode. Thus a single frequency at 120 dB is more dangerous than white noise at 120 dB where the energy is distributed of many modes.
DTIC
Boundary Layer Transition; Aerodynamic Noise; Boundary Layers; Free Flow; Broadband

19990025391 NASA Goddard Space Flight Center, Greenbelt, MD USA

Design and Testing of a Cryogenic Capillary Pumped Loop Flight Experiment

Bugby, David C., Swales Aerospace, USA; Kroliczek, Edward J., Swales Aerospace, USA; Ku, Jentung, NASA Goddard Space Flight Center, USA; Swanson, Ted, NASA Goddard Space Flight Center, USA; Tomlinson, B. J., Air Force Research Lab., USA; Davis, Thomas M., Air Force Research Lab., USA; Baumann, Jane, Cullimore and Ring Technologies, Inc., USA; Cullimore, Brent, Cullimore and Ring Technologies, Inc., USA; 1998; 10p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper details the flight configuration and pre-flight performance test results of the fifth generation cryogenic capillary pumped loop (CCPL-5). This device will fly on STS-95 in October 1998 as part of the CRYOTSU Flight Experiment. This flight represents the first in-space demonstration of a CCPL, a miniaturized two-phase fluid circulator for thermally linking cryogenic cooling sources to remote cryogenic components. CCPL-5 utilizes N2 as the working fluid and has a practical operating range of 75-110 K. Test results indicate that CCPL-5, which weighs about 200 grams, can transport over 10 W of cooling a distance of 0.25 m (or more) with less than a 5 K temperature drop.

Author

Performance Tests; Cryogenic Cooling; Space Transportation System; Nitrogen

19990025759 NASA Langley Research Center, Hampton, VA USA

Effective Thermal Conductivity of High Temperature Insulations for Reusable Launch Vehicles

Daryabeigi, Kamran, NASA Langley Research Center, USA; February 1999; 35p; In English

Contract(s)/Grant(s): RTOP 242-33-03-29

Report No.(s): NASA/TM-1999-208972; NAS 1.15:208972; L-17808; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An experimental apparatus was designed to measure the effective thermal conductivity of various high temperature insulations subject to large temperature gradients representative of typical launch vehicle re-entry aerodynamic heating conditions. The insulation sample cold side was maintained around room temperature, while the hot side was heated to temperatures as high as 1800 degrees Fahrenheit. The environmental pressure was varied from 0.0001 to 760 torr. All the measurements were performed in a dry gaseous nitrogen environment. The effective thermal conductivity of Saffil, Q-Fiber felt, Cerachrome, and three multilayer insulation configurations were measured.

Author

Thermal Conductivity; Multilayer Insulation; Reusable Launch Vehicles; Reentry Effects; Thermal Insulation

19990025760 NASA Langley Research Center, Hampton, VA USA

Demonstration of Imaging Flow Diagnostics Using Rayleigh Scattering in Langley 0.3-Meter Transonic Cryogenic Tunnel

Shirinzadeh, B., NASA Langley Research Center, USA; Herring, G. C., NASA Langley Research Center, USA; Barros, Toya, Spelman Coll., USA; February 1999; 16p; In English

Contract(s)/Grant(s): RTOP 522-31-61-01

Report No.(s): NASA/TM-1999-208970; NAS 1.15:208970; L-17801; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The feasibility of using the Rayleigh scattering technique for molecular density imaging of the free-stream flow field in the Langley 0.3-Meter Transonic Cryogenic Tunnel has been experimentally demonstrated. The Rayleigh scattering was viewed with a near-backward geometry with a frequency-doubled output from a diode-pumped CW Nd:YAG laser and an intensified charge-coupled device camera. Measurements performed in the range of free-stream densities from 3 x 10(exp 25) to 24 x 10(exp 25) molecules/cu m indicate that the observed relative Rayleigh signal levels are approximately linear with flow field density. The absolute signal levels agree (within approx. 30 percent) with the expected signal levels computed based on the well-known quantities of flow field density, Rayleigh scattering cross section for N2, solid angle of collection, transmission of the optics, and the independently calibrated camera sensitivity. These results show that the flow field in this facility is primarily molecular (i.e., not contaminated by clusters) and that Rayleigh scattering is a viable technique for quantitative nonintrusive diagnostics in this facility.

Author

Rayleigh Scattering; Flow Visualization; Charge Coupled Devices; Nitrogen; Imaging Techniques; Transonic Wind Tunnels; Cryogenics

19990025929 Arizona Univ., Dept. of Aerospace and Mechanical Engineering, Tucson, AZ USA

High Performance Pre- and Post-Processing Equipment for Direct Numerical Simulations (DNS) and Large-Eddy-Simulations of Transitional and Turbulent Flows ***Final Report, 1 Apr. - 31 Dec. 1997***

Fasel, Hermann F.; Sep. 02, 1998; 9p; In English

Contract(s)/Grant(s): F49620-97-1-0182

Report No.(s): AD-A359445; AFRL-SR-BL-TR-99-0021; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

With the funding from DURIP grant F46920-97-1-0812 we purchased a Silicon Graphics Origin 2000 with 12 processors, 2GB memory, and 18GB disk space, as well as flow visualization software and several peripherals, accessories and PC's for pre- and post-processing support. The equipment has been utilized effectively to perform pre- and post-processing tasks for our DoD funded research projects. The multi-processor capability has allowed us to develop and test our Navier-Stokes codes locally and improve their performance before performing production runs at the DoD High-Performance Computing Centers. The high performance multi-processing capability has enabled effective post-processing of the massive time-dependent data sets that are delivered by the simulations on the DoD supercomputers.

DTIC

Turbulent Flow; Flow Visualization; Computerized Simulation; Large Eddy Simulation

19990025998 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA

\Influence of wettability on constitutive relations and its role in up scaling

Soll, W. E., Department of Energy, USA; Gray, W. G., Department of Energy, USA; Tompson, A. F. B., Department of Energy, USA; Dec. 31, 1998; 9p; In English; 12th; Computational methods in water resources

Report No.(s): DE98-003463; LA-UR-98-570; CONF-980670; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Lattice Boltzmann (LB) method is applied to simulating multi fluid flow in porous media at sub-pore resolution to determine constitutive behaviors. The authors address the importance of the LB technique for identifying process based constitutive relationships, and demonstrate its application through analysis of the influence of wettability on interfacial areas and constitutive relationships. Porous media surface wettability is varied from uniformly strongly wetted by the resident fluid through strongly wetted by the displacing fluid. Spatially variable wettability is also demonstrated. Primary imbibition and drainage displacements are run, and interfacial areas (IFA) as a function of time are determined and compared. Results indicate that wettability is an important factor in displacement behavior and resulting interfacial area. Primary imbibition in a strongly wet material under capillary dominated flows produces film flow, resulting in high IFAs that decrease with increasing saturation and viscous forces. Primary drainage produces initially high IFA that decreases slightly with increasing saturation or pressure drop. Surfaces with spatially variable wetting can have a strong influence on resulting fluid distributions and fluid flow.

NTIS

Wettability; Capillary Flow

19990026053 Pennsylvania State Univ., Graduate School of Architectural Engineering Dept., University Park, PA USA

Protocol for Field Testing of Tall Buildings to Determine Envelope Air Leakage Rate

Lee, Brian W., Pennsylvania State Univ., USA; May 1998; 166p; In English

Report No.(s): AD-A358499; AFIT-98-091; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The objective of this project was to develop a relatively simple, yet accurate method for testing the envelope leakage rate of tall buildings. Alternative pressurization test techniques were developed and two methods, the floor-by-floor blower door method and the air handler method, were tested on two buildings. The floor-by-floor blower door method involves isolating and measuring the leakage flow rate through a single floor. Difficulty in eliminating inter-floor leakage in the floor-by-floor blower door method led to the development of the air handler method. In this method, air handler fans pressurize the whole building or a building zone using outdoor air. The outdoor air flow rate through the fan is measured using a tracer gas dilution technique with only one flow meter and one concentration sensor. The leakage characteristics of the test zone can then be calculated by establishing a relationship between the pressure differential across the building envelope and the corresponding outdoor air flow. The air handler method using a tracer gas flow measurement technique provides the most straightforward and efficient procedure to determine the leakage characteristics of tall buildings. It produced highly repeatable results with an estimated uncertainty of 5.5%.

DTIC

Protocol (Computers); Flowmeters; Flow Velocity; Flow Measurement; Air Flow

19990026060 Department of Energy, Washington, DC USA

Potential Hydraulic Modelling Errors Associated with Rheological Data Extrapolation in Laminar Flow

Shadday, M. A., Department of Energy, USA; Mar. 20, 1997; 8p; In English

Report No.(s): DE97-008839; WSRC-MS-97-0295; CONF-970824; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The potential errors associated with the modelling of flows of non-Newtonian slurries through pipes, due to inadequate rheological models and extrapolation outside of the ranges of data bases, are demonstrated. The behaviors of both dilatant and pseudoplastic fluids with yield stresses, and the errors associated with treating them as Bingham plastics, are investigated.

NTIS

Laminar Flow; Pipe Flow; Rheology; Slurries; Errors; Mathematical Models; Hydraulic Fluids

19990026074 Alabama Univ., Huntsville, AL USA

Stability Limits and Dynamics of Nonaxisymmetric Liquid Bridges ***Final Report***

Alexander, J. Iwan D., Alabama Univ., USA; 1998; 4p; In English

Contract(s)/Grant(s): NAG3-1864; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Theoretical and experimental investigation of the stability of nonaxisymmetric and nonaxisymmetric bridges contained between equal and unequal radii disks as a function of Bond and Weber number with emphasis on the transition from unstable axisymmetric to stable nonaxisymmetric shapes. Numerical analysis of the stability of nonaxisymmetric bridges for various orientations of the gravity vector for equal and unequal disks. Experimental and theoretical investigation of large (nonaxisymmetric) oscillations and breaking of liquid bridges. This project involves both experimental and theoretical work. Static and dynamic experiments are conducted in a Plateau tank which makes a range of static Bond numbers accessible.

Derived from text

Numerical Analysis; Data Acquisition; Stability; Liquid Bridges

19990026190 California Inst. of Tech., Pasadena, CA USA

Interaction of Chemistry, Turbulence, and Shock Waves in Hypervelocity Flow ***Final Report***

Candler, G.; Dimotakis, P.; Hornung, H.; Leonard, A.; Meiron, D.; Jan. 25, 1999; 89p; In English

Contract(s)/Grant(s): F49620-93-1-0338; AF Proj. 3484

Report No.(s): AD-A359687; GALCIT-FM-98-10; AFRL-SR-BL-TR-99-0029; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Significant contributions were made in a four-year interdisciplinary experimental, numerical and theoretical program to extend the state of knowledge and understanding of the effects of chemical reactions in hypervelocity flows. The program addressed the key problems in aerothermochemistry that arise from the interaction between the three strongly nonlinear effects: Compressibility; vorticity; and chemistry. Results included: (1) Discovery of dramatic damping effects of nonequilibrium vibration and chemistry on transition in hypervelocity flows; (2) Proper formulation of parameters for reacting blunt-body flows. (3) Effects of nonequilibrium chemistry in shock-on-shock interaction; (4) New experiments on, and correlation with theory of high-enthalpy flap-induced separation; (5) Computations of interaction of a shock wave with density interfaces and with compressible Hill's spherical vortex; (6) Extensive clarification of phenomena in supersonic shear flows using new diagnostic and computational tools; (7) New experiments and computations of hypervelocity double-one flow yielded insights into vibration-dissociation coupling; (8) First-principles computations of electron collision cross-sections with diatomic molecules and CO2; and (9) Development of new diagnostic technique LITA for accurate non-intrusive point measurement of gas properties.

DTIC

Turbulence; Chemical Reactions; Hypervelocity Flow; Aerothermochemistry; Nonequilibrium Flow; Supersonic Flow; Blunt Bodies; Compressibility; Reacting Flow; Shear Flow; Shock Wave Interaction; Transition Flow; Vorticity

19990026225 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA

Effect of finite particle interaction time in granular systems

Zhang, D. Z., Department of Energy, USA; Rauenzahn, R. M., Department of Energy, USA; Dec. 31, 1998; 8p; In English; Multiphase flow

Report No.(s): DE98-003468; LA-UR-98-207; CONF-980643; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Almost all previously published theoretical papers that propose constitutive relations for granular flows use some form of kinetic theory, which neglects effects of finite particle interaction time and multiparticle interactions. In dense systems, these effects contain essential physics and determine the evolution of the stress system in granular flows. In this paper, the authors dem-

onstrate the importance of these effects and study the behavior of the granular stress in a dense system. The particle interaction time is a random variable in a granular system, and they show that its probability distribution obeys an exponential law. The temporal decay of this probability represents the destruction of contacts between particles and is related to the relaxation of the collisional stress in a granular system. by considering the balance between creation and destruction of contacts, they derive a constitutive relation for collisional stress. Depending on the form of the model chosen to approximate forces developed during particle interactions, the constitutive relation can predict either viscoelastic or viscoplastic behavior of the collisional stress. Numerical simulations are performed to verify the theoretical findings and to study further the properties of dense granular systems.
NTIS
Particle Interactions; Granular Materials

19990026279 Department of Energy, Office of Energy Research, Washington, DC USA
Using TRINET for simulating flow and transport in porous media
Najita, J., Department of Energy, USA; Doughty, C., Department of Energy, USA; Aug. 1, 1998; 61p; In English
Report No.(s): DE98-059387; LBNL-42158; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The finite element model TRINET calculates transient or steady-state fluid flow and solute transport on a lattice composed of one-dimensional finite elements (i.e., pipes) of porous medium. TRINET incorporates an adaptive gridding algorithm to minimize numerical dispersion for transport calculations. Although TRINET was originally developed to study fracture networks, the primary interest here is in applying TRINET more generally to simulate transport in porous media (or a fractured medium being treated as an effective continuum). This requires developing expressions to relate TRINET inputs to equivalent parameters used to describe flow and transport in homogeneous porous media. In this report, the authors briefly describe the basic TRINET formulation for flow and transport, present TRINET equivalences for porous medium parameters, and compare TRINET to analytical solutions using the proposed porous medium equivalents.
NTIS
Porous Materials; Fluid Flow; Finite Element Method; Fracturing; Pipes (Tubes); Unsteady Flow

19990026522 Department of the Navy, Washington, DC USA
Surface Layer Comprising Micro-Fabricated Tiles for Electromagnetic Control of Fluid Turbulence in Sea Water
Bandyopadhyay, Promode R., Inventor; Aug. 11, 1998; 11p; In English; Supersedes US-Patent-Appl-SN-668031, AD-D018071.
Patent Info.: Filed 14 Jun. 96,; US-Patent-5,791,275; US-Patent-Appl-SN-668,031
Report No.(s): AD-D019234; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A surface layer for use in connection with an object adapted for motion through a fluid includes an array of tiles each having a pair of electrodes and a pair of magnetic poles positioned to generate respective electric and magnetic fields generally transverse to each other. Either or both of the electrodes or magnetic poles are controllable to provide adjustable electrical and/or controllable magnetic fields. A plurality of turbulence sensors is provided each located proximate to and generally upstream of a tile. Each turbulence sensor generating a turbulence signal representative of fluid turbulence proximate thereto. A control circuit for controlling the electrical field generated by the electrodes and/or the magnetic field generated by the magnetic pole in relation to the turbulence signal from the turbulence sensors, thereby to generate a lorentz force for controlling the fluid. The length and time scales of the electro-magnetic tiles can be matched to those of near-wall turbulence in high Reynolds number flows. The tiles can be fabricated using silicon micro-fabrication or printed circuit board techniques, which provides for cost-effective fabrication and ensures relatively lightweight and reduced energy requirements. Due to their smallness, plurality and amenability, digital microprocessor technology with appropriate algorithm maybe used to control near-wall turbulence.
DTIC
Electromagnetic Fields; Turbulence; Boundary Layer Control; Magnetohydrodynamics; Sea Water

19990026695 Office National d'Etudes et de Recherches Aerospatiales, Paris, France
Use of Orthogonal Wavelets in the Analysis of Two- and Three-Dimensional Inhomogeneous Turbulent Flows *Utilisation des Ondelettes Orthogonales dans l'Analyse des Ecoulements Turbulents Inhomogenes Bi et Tridimensionnels*
DoKhac, Minh, Office National d'Etudes et de Recherches Aerospatiales, France; Feb. 1998; ISSN 0078-3780; 315p; In English
Report No.(s): ESA-TT-1355; ONERA-NT-1998-3; ONERA-NT-1997-4; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche

The aim of this work is to study how decomposition over orthonormal wavelet bases can contribute to the analysis of numerical data extracted from simulations in inhomogeneous and incompressible turbulent flows, and to the enhancement of direct simulation codes. The present report is comprised of five parts. Part one presents a concise review of the various mathematical developments on the wavelets, part two describes the implementation of a periodic wavelet analysis tool. This relies essentially

on constructing fundamental turbulence quantities which are local in both space and scale, with the help of the wavelet analysis tool and wavelet coefficients. In particular, it defines, in theory and in practice, a local energy spectrum (or enstrophy spectrum). This tool is used in part three to characterize the energy distribution, simultaneously in space and scale, of two different two-dimensional flows: an incompressible homogeneous turbulence and a time-growing mixing layer. For these flows, wavelet analyses reveal that the zones producing the smallest turbulence scales are localized in the shear regions outside the large vortices. A study of the spatial correlation between the small scale production zones and the deformation zones, within a strongly three-dimensional mixing layer, is proposed in part four. This study, carried out with the help of the wavelet analysis tool associated with classical methods of analysis (graphical visualization, Fourier analysis), is intended to check whether the correlations between these physical characteristics, discerned within the framework of a 3-D flow, are of the same kind as those observed for a 2-D flow. With a view to improving direct simulation, the final part proposes an application of wavelets to the local refinement of the computation grid.
Author
Wavelet Analysis; Two Dimensional Flow; Three Dimensional Flow; Turbulent Flow; Incompressible Flow; Mixing Layers (Fluids); Computational Grids; Computational Fluid Dynamics

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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.

19990025233 NASA Goddard Space Flight Center, Greenbelt, MD USA
Development and Testing of the CRYOTSU Flight Experiment
Bugby, David C., Swales Aerospace, USA; Stouffer, Charles J., Swales Aerospace, USA; Hagood, Robert M., Swales Aerospace, USA; Rich, Michael, Air Force Research Lab., USA; Tomlinson, B. J., Air Force Research Lab., USA; Davis, Thomas M., Air Force Research Lab., USA; Ku, Jentung, NASA Goddard Space Flight Center, USA; Swanson, Theodore D., NASA Goddard Space Flight Center, USA; 1998; 5p; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This paper describes the development and ground testing of the CRYOTSU thermal management flight experiment. CRYOTSU incorporates three cryogenic temperature experiments and one ambient temperature experiment into a Hitchhiker (HH) Get Away Special (GAS) Canister that is currently scheduled to fly on STS-95 in October 1998. The cryogenic experiments consist of a nitrogen triple-point cryogenic thermal storage unit (CTSU), a nitrogen cryogenic capillary pumped loop (CCPL), and a hydrogen gas-gap cryogenic thermal switch (CTSW). The ambient experiment is a carbon-fiber core, paraffin-filled thermal storage unit. Test results of integrated flight canister testing are provided herein for the CTSU and CCPL experiments. Pre-integration laboratory test results are provided for the CTSW. Design information and test results for the ambient experiment are not included. Author
Cryogenic Temperature; Flight Tests; Cryogenics; Space Transportation System; Carbon Fibers; Get Away Specials (STS); Ground Tests

19990025287 Pennsylvania State Univ., Dept. of Electrical Engineering, University Park, PA USA
Performance Analysis of a Multistatic Coherent Doppler Lidar
Magee, Eric P., Pennsylvania State Univ., USA; Jan. 07, 1999; 169p; In English
Report No.(s): AD-A359106; AFIT-FY99-24; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Wind velocity can be obtained using a light detection and ranging (lidar) system by measuring the Doppler shift of the scattered return from aerosols and particulates in the atmosphere. Doppler lidar systems for wind velocity measurements can be classified into two categories, coherent detection and direct (or incoherent) detection. Under each category there are novel approaches to measuring the return signal frequency. Regardless of the measurement mode, the goal for both types is to measure the frequency difference between the transmitted laser pulse and the scattered signal. This frequency shift is proportional to the velocity of the scatterers. How accurately these systems can measure the frequency shift, and thus the velocity, is dependent upon the system characteristics. Existing Doppler lidar systems employ monostatic configurations which require scanning a volume to obtain wind velocity and direction. Range resolution in these systems is normally obtained by using a pulsed laser system. This places a fundamental limit on the range-velocity resolution product. The purpose of this research is to investigate the feasibility of utilizing a multistatic configuration for measuring 3-dimensional vector winds. In the multistatic configuration, horizontal and vertical resolution are determined by the telescope field-of- view, laser divergence, and baseline separation distance between the laser and the

telescope. This enables the use of a continuous-wave (CW) or long pulse laser transmitter (narrow spectral width) and eliminates the dependence between range and velocity resolution. The results of this research show that a multistatic pulsed Doppler lidar system will provide estimates of wind velocity with errors less than 1 m/sec and spatial resolution between 10 and 100 cm3 within the atmospheric boundary layer. Detailed signal-to-noise ratio calculations indicate that small transmit and local oscillator beams actually improve system performance.
DTIC
Optical Radar; Doppler Radar; Reliability Analysis; Wind Velocity; Velocity Measurement; Estimates

19990025480 Naval Academy, Annapolis, MD USA
Optimization of the Photon Response for a LiF Thermoluminescent Dosimeter
Carnell, Robert C.; Jan. 1998; 114p; In English
Report No.(s): AD-A359145; USNA-253; USNA-1531-2; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
A Harshaw LiF TLD card holder was optimized for maximum discrimination between different energies of irradiating photons in order to improve the dosimetric response. Since dose is proportional energy deposited, a theoretical model was created to estimate the TLD response by calculating the energy deposition. These results correlated with experimental data from NIST to within 20%. In order to increase the accuracy of the model, energy deposition calculations were made using the MCNP particle transport program. MCNP improved the correlation of the modeled data with the experimental data. Next, Harshaw's 8825 card holder was optimized for photon energy determination by analyzing the card holder's response with different filter materials and thickness. This analysis showed that increasing the copper filter thickness by 20 times and doubling the tin filter thickness compared to the original 8825 design improved the TLD's photon energy determination response. The improved 8825 card holder was constructed and experiments were conducted at Armstrong Laboratories. The MCNP model predicted the experimental response of the card holder to within two standard deviations for all beams except M60. Finally, recommendations for a new card holder were made by Naval Dosimetry Center which included a modified filter for improved dose determination.
DTIC
Lithium Fluorides; Dosimeters; Thermoluminescence; Energy Transfer

19990025575 Charles Univ., Prague, Stredocesky, Czechoslovakia
Focal Plane Array Technology for IR Detectors ***Final Report***
Hoschl, Pavel, Charles Univ., Prague, Czechoslovakia; Jun. 1996; 27p; In English
Contract(s)/Grant(s): F61708-95-W-0366
Report No.(s): AD-A358855; EOARD-SPC-95-4048; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This report results from a contract tasking Charles University/Institute of Physics as follows: Provide an annotated bibliography of research and development projects undertaken by the Czech Republic during the past 10 years in focal plane array technology for IR detectors in the 1-15 micrometer range.
DTIC
Infrared Detectors; Bibliographies; Arrays; Research and Development; Focal Plane Devices

19990025888 NASA Ames Research Center, Moffett Field, CA USA
Evaluating Extinction Values using Wire Impactor Data ***Final Report***
1998; 7p; In English
Contract(s)/Grant(s): NCC2-5283; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
The purpose of the study was to compare the extinctions calculated from data obtained with the Ames Wire Impactor to extinctions measured with the SAGE H satellite system. The comparison was intended to serve as a validation of the extinctions obtained using the wire impactor data. It was felt that if the extinctions obtained by the two diverse methods agreed well, it would be an indication that the number densities measured on the wires were correct.
Author
Comparison; Evaluation; Computation; Extinction

19990026046 Army Research Lab., Sensors Directorate, Adelphi, MD USA
Hybrid Template- and Model-Based ATR Formulation
Subotic, Nikola S., Environmental Research Inst. of Michigan, USA; Gorman, John D., Environmental Research Inst. of Michigan, USA; Welby, Stephen, Army Research Lab., USA; Jan. 1998; 5p; In English; Prepared in collaboration with Environmental Research Inst. of Michigan, Ann Arbor.
Report No.(s): AD-A358575; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Template based automatic target recognition (ATR) algorithms such as the Synthetic Aperture Radar Target Location and Recognition System (STARLOS) algorithm typically use separate templates to represent target signatures for ranges of articulations, aspect, depression, and squint angles. There is a performance tradeoff between ATR accuracy and the number of templates used. We use a hybrid model/template with target models to augment a small set of target templates. The basic idea will be to determine the transformation or perturbations required to modify a given template so that it accurately represents the signature of a neighboring sensor geometry or target articulation. by incorporating a model for these perturbations into the ATR algorithm, we can reduce the total number of templates required and provide robustness to new collection geometries, obscuration, and articulation.
DTIC
Occultation; Perturbation; Radar Targets; Radar Tracking; Robustness (Mathematics); Synthetic Aperture Radar; Target Recognition; Templates

19990026093 Army Research Lab., Sensors Directorate, Adelphi, MD USA
Comparison of MBT and BTQB Quantum Well Infrared Photodetectors and Implications for Multicolor Design ***Final Report, 1 Oct. 1996 - 30 Sep. 1997***
Kennerly, Stephen W.; Beekman, Daniel W.; Little, John W.; Goldberg, Arnold C.; Leavitt, Richard P.; Dec. 1998; 18p; In English
Report No.(s): AD-A358747; ARL-MR-393; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
A comparison is presented between two GaAs/AlGaAs quantum well infrared photodetector (QWIP) designs: the miniband transport (MBT) and the bound-to-quasibound (BTQB). Two QWIP test arrays were prepared, designed to have the same peak operating wavelength, doping density, barrier thickness, and excited state binding energy. The detectors are long wavelength infrared (LWIR), each having about a 9.1-microns-peak wavelength. The detector array test structures used edge coupling to remove the grating or optical coupling structure effects from the detector response characteristics. Extensive bias and spectral-dependent blackbody response and specific detectivity data will be presented. The data show that MBT and BTQB QWIPs offer comparable performance.
DTIC
Aluminum Gallium Arsenides; Gallium Arsenides; Infrared Radiation; Optical Coupling; Photometers; Semiconductors (Materials)

19990026111 Naval Research Lab., Advanced Concepts Branch, Washington, DC USA
Spectral Calibration, Spatial Mapping and Flat Fielding Studies of the Dark HORSE 1 (DH1) March Data Collection ***Final Report***
Stellman, Christopher M.; Hazel, Geoffrey G.; Schuler, Jonathon M.; Bucholtz, Frank; Michalowicz, Joseph V.; Jan. 29, 1999; 47p; In English
Report No.(s): AD-A359348; NRL/MR/5620--99-8332; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Recently researchers at the Naval Research Laboratory (NRL) have successfully demonstrated autonomous, real time, hyperspectral detection of airborne and military ground targets. Real-time autonomous cueing of a high-resolution imager, and designation of targets with pointing optics and a pulsed laser was also demonstrated. The work was performed under NRL's Dark HORSE effort, the culmination of a four-year Multispectral Overhead IR/EO Surveillance (MOVIES) program to develop real-time hyperspectral detection, cueing, target location, and target designation capabilities. The program will provide enabling technology for future manned, reconnaissance, and Uninhabited Combat Air Vehicle (UCAV) systems. The following describes the spectral calibration and flat fielding studies performed on a recently collected data set of the Dark HORSE 1 (DH1) visible hyperspectral sensor. The procedures used for spectral calibration and mapping of the sensor's focal plane array (FPA) are described and a real-time algorithm for corrective re-mapping of the image data is presented in detail. Also, procedures used for pre and post-flight flat fielding of the sensor's radiometric response are described with an emphasis on the potential advantages and disadvantages of each. Results of these efforts are discussed and appropriate conclusions are drawn.
DTIC
Data Acquisition; Calibrating; Targets; Detection

19990026122 NASA, Washington, DC USA
MAMA Detector ***Final Report***
Bowyer, Stuart, NASA, USA; [1998]; 1p; In English
Contract(s)/Grant(s): NGRO5-003-450; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
Work carried out under this grant led to fundamental discoveries and over one hundred publications in the scientific literature. Fundamental developments in instrumentation were made including all the instrumentation on the EUVE satellite, the invention

of a whole new type of grazing instrument spectrometer and the development of fundamentally new photon counting detectors including the Wedge and Strip used on EUVE and many other missions and the Time Delay detector used on OREFUS and FUSE. The Wedge and Strip and Time Delay detectors were developed under this grant for less than two million dollars and have been used in numerous missions most recently for the FUSE mission. In addition, a fundamentally new type of diffuse spectrometer has been developed under this grant which has been used in instrumentation on the MMSAT spacecraft and the Lewis spacecraft. Plans are underway to use this instrumentation on several other missions as well.
Derived from text
Extreme Ultraviolet Explorer Satellite; Documents; Photons; Fabrication; Radiation Counters

19990026128 Department of Energy, Office of Energy Research, Washington, DC USA
5 MeV Mott Polarimeter Development at Jefferson Lab
Price, J., Department of Energy, USA; Dec. 31, 1997; 7p; In English; 7th; Polarized Gas Targets and Polarized Beams, Unknown
Report No.(s): DE98-000736; DOE/ER/40150-1192; CONF-970894; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Low energy (E(sub k)=100 keV) Mott scattering polarimeters are ill-suited to support operations foreseen for the polarized electron injector at Jefferson Lab. One solution is to measure the polarization at 5 MeV where multiple and plural scattering are unimportant and precision beam monitoring is straightforward. The higher injector beam current offsets the lower cross- sections. Recent improvements in the CEBAF injector polarimeter scattering chamber have improved signal to noise.
NTIS
Polarimeters; Electron Beams; Electron Diffraction

19990026145 Department of Energy, Office of Energy Research, Washington, DC USA
CMS central hadron calorimeter: Update
Freeman, J., Department of Energy, USA; Jun. 30, 1998; 14p; In English; SCIFI 1997: Scintillator and fiber detectors
Report No.(s): DE98-057361; FNAL/C-98/194-E; CONF-9710253; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The CMS central hadron calorimeter is a brass absorber/ scintillator sampling structure. We describe details of the mechanical and optical structure. We also discuss calibration techniques, and finally the anticipated construction schedule.
NTIS
Calorimeters; Hadrons

19990026204 Institute of Industrial Technology TNO, Dept. of Surface Technology, Helder, Netherlands
Development of Electronic Sensor Prototype Validation ***Interim Report Ontwikkeling Elektrochemische Sensor Valdatie Protype***
vanWesting, E. P. M., Institute of Industrial Technology TNO, Netherlands; deGoeje, M. P., Institute of Industrial Technology TNO, Netherlands; Suurmond, A., Institute of Industrial Technology TNO, Netherlands; Ferrari, G. M., Institute of Industrial Technology TNO, Netherlands; Oct. 07, 1998; In Dutch; Original contains color illustrations
Contract(s)/Grant(s): A96/KM/114
Report No.(s): TD98-0364; CA/98.9018; Copyright; Avail: Issuing Activity (TNO Inst. of Industrial Technology, Dept. of Surface Technology, Ambachtsweg 8A, Postbus 57, 1780 AB Den Helder), Hardcopy, Microfiche

In this report the development and validation is described of a sensor for in situ impedance measurements for coating assessment. The aim of the development is an in situ quantitative determination of the amount of weathering to enable prediction of service life. Basis tD this is the behaviour of the coating in Immersion, where is observed that the individual coating layers have their own contribution to the coating impedance. The impedance of the coatings also clearly shows the water uptake, curing during immersion, and onset of delamination. In this part of the research the effect of cathodic protection was investigated. This does not affect the behaviour of the coating impedance that is normally observed during immersion. From the results R can be derived that the design of the sensor is valid.
Author
Prototypes; Product Development; Fabrication; Electronic Equipment; Assessments; Cathodic Coatings; Measuring Instruments

19990026235 Michigan Univ., Ann Arbor, MI USA
High Resolution Doppler Lidar ***Final Report***
October 1996; 4p; In English
Contract(s)/Grant(s): NAG1-1331; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This Grant supported the development of an incoherent lidar system to measure winds and aerosols in the lower atmosphere. During this period the following activities occurred: (1) an active feedback system was developed to improve the laser frequency stability; (2) a detailed forward model of the instrument was developed to take into account many subtle effects, such as detector non-linearity; (3) a non-linear least squares inversion method was developed to recover the Doppler shift and aerosol backscatter without requiring assumptions about the molecular component of the signal; (4) a study was done of the effects of systematic errors due to multiple etalon misalignment. It was discovered that even for small offsets and high aerosol loadings, the wind determination can be biased by as much as 1 m/s. The forward model and inversion process were modified to account for this effect; and (5) the lidar measurements were validated using rawinsonde balloon measurements. The measurements were found to be in agreement within 1-2 m/s.
Derived from text
Doppler Radar; Fabrication; Velocity Measurement; Aerosols; Feedback; Nonlinearity; Optical Radar; Wind Measurement

19990026344 Department of Energy, Office of Energy Research, Washington, DC USA
Internally reflecting Cherenkov detector (DIRC): Properties of the fused silica radiators
Adam, I., Department of Energy, USA; Aston, D., Department of Energy, USA; Aleksan, R., Department of Energy, USA; Nov. 30, 1997; 7p; In English; Nuclear Science, Unknown, Unknown; Sponsored by Institute of Electrical and Electronics Engineers, USA
Report No.(s): DE98-059169; SLAC-PUB-7707; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The DIRC, a new type of ring-imaging Cherenkov detector that images internally reflected Cherenkov light, is being constructed as the main hadronic particle identification component of the BABAR detector at SLAC. The device makes use of 5 meter long fused silica (colloquially called quartz) bars, which serve both as the Cherenkov radiators and as light pipes for transmitting the light to an array of photo-multiplier tubes. This paper describes a program of research and development aimed at determining whether bars that meet the stringent requirements of the DIRC can be obtained from commercial sources. The results of studies of bulk absorption of fused silica, surface finish, radiation damage and bulk inhomogeneities are discussed.
NTIS
Cerenkov Counters; Hadrons; Silica Glass

19990026408 Department of Energy, Office of Environmental Restoration and Waste Management, Washington, DC USA
Integration and evaluation of a position sensor with continuous read-out for use with the Environmental Measurement-While-Drilling Gamma Ray Spectrometer system
Normann, R. A., Department of Energy, USA; Lockwood, G. J., Department of Energy, USA; Williams, C. V., Department of Energy, USA; Selph, M. M., Department of Energy, USA; Feb. 28, 1998; 10p; In English; North American No-Dig '98, USA
Report No.(s): DE98-004136; SAND-98-0476C; CONF-980418; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Environmental Measurement-While-Drilling-Gamma Ray Spectrometer (EMWD- GRS) system represents an innovative blend of new and existing technology that provides real-time environmental and drill bit data during drilling operations. The EMWD-GRS technology was demonstrated at Savannah River Site (SRS) F-Area Retention Basin. The EMWD-GRS technology demonstration consisted of continuously monitoring for gamma-radiation-producing contamination while drilling two horizontal boreholes below the backfilled waste retention basin. These boreholes passed near previously sampled locations where concentrations of contaminant levels of cesium had been measured. Contaminant levels continuously recorded by the EMWD-GRS system during drilling were compared to contaminant levels previously determined through quantitative laboratory analysis of soil samples. The results show general agreement between the soil sampling and EMWD-GRS techniques for Cs-137. The EMWD-GRS system has been improved by the integration of an orientation sensor package for position sensing (PS) (EMWD-GRS/PS). This added feature gives the capability of calculating position, which is tied directly to EMWD-GRS sensor data obtained while drilling. The EMWD-GRS/PS system is described and the results of the field tests are presented.
NTIS
Waste Disposal; Cesium 137; Evaluation; Radioactive Wastes; Monitors; Gamma Ray Absorptiometry; Soil Sampling; Drilling; Contamination

19990026446 Department of the Navy, Washington, DC USA
Triboelectric Sensor for Use as Microphone or Hydrophone
Fraioli, Dominic, Inventor; Aug. 12, 1998; 11p; In English
Patent Info.: Filed 12 Aug. 1998; US-Patent-Appl-SN-09/137,869
Report No.(s): AD-D019162; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

A triboelectric sensor is used to measure continuous energy changes, such as sound or acoustic energy, by providing a varying charge generated by the triboelectric sensor in response to movement caused by the energy changes. The triboelectric sensor includes a cable, such as a twisted cable pair, having two insulated conductors. A first end of the insulated conductors is coupled to a capacitive element, and a second end of the insulated conductors is coupled to an amplifier. The capacitive element holds the charge generated by the conductors and allows the charge to vary. The amplifier receives and amplifies the varying charge and provides a voltage output that corresponds to the movement of the cable caused by the sound or continuous energy change. The triboelectric sensor is suitable for use as a microphone or hydrophone, such as, for example, in a towed underwater array.
DTIC
Electric Potential; Capacitance; Sound Waves; Acoustic Emission

19990026450 Department of the Navy, Washington, DC USA
Target Seeking Free Gyro
Hoban, Fay, Inventor; Aug. 11, 1998; 11p; In English
Patent Info.: Filed 28 Apr. 97,; US-Patent-Appl-SN-846,203; US-Patent-5,791,591
Report No.(s): AD-D019170; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A free gyro for use with a missile's seeker which allows the seeker to track the target. The free gyro includes a support structure having a pair of roll axis forks which support a pitch gimbal and allow for rotational movement of the pitch gimbal about a pitch axis. Attached to the pitch gimbal is an outer gimbal support structure which includes a U shaped support member having a pair of support posts which support an outer gimbal ring and allow for rotational movement of the outer gimbal ring about the pitch axis. The outer gimbal ring supports and provides for rotational movement of an inner gimbal ring about an inner gimbal axis which is perpendicular to the pitch axis. The inner gimbal ring supports the free gyro assembly and allows the free gyro assembly to spin about a roll axis to stabilize the free gyro assembly. The free gyro assembly includes the optical system for the missile's seeker or tracking device and the support structure for the optical system. The free gyro has a gimbal drive and control system comprising gyro motor drive coils. precession coils. cage coils and permanent magnets which are integral to the pitch gimbal. the outer gimbal and the inner gimbal and are used to control and position the gimbals of the free gyro as the missile's seeker tracks and men locks onto the target.
DTIC
Gyroscopes; Targets; Missiles; Tracking (Position)

19990026465 Department of Energy, Office of Energy Research, Washington, DC USA
EGS4 calculations for a Cd-Zn-Te detector to measure synchrotron radiation at PEP-2
Nelson, W. R., Department of Energy, USA; Borak, T., Department of Energy, USA; Malchow, R., Department of Energy, USA; Toki, W., Department of Energy, USA; Kadyk, J., Department of Energy, USA; Aug. 20, 1997; 12p; In English; 1st; EGS4, Unknown
Report No.(s): DE98-059122; SLAC-PUB-7620; CONF-9708183; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Calculations have been performed with the EGS4 Code System for a CdZnTe semiconductor detector to be used in background studies of synchrotron radiation at PEP-2. The simulations take into account K-shell fluorescent-photon production in a CdZnTe mixture, electron-hole pair collection and electronic-noise broadening. The results are compared with measurements made with encapsulated Am-241, Ba-133 and Cd-109 sources.
NTIS
Background Radiation; Synchrotron Radiation; Detectors; Radioactive Isotopes; Semiconductors (Materials)

19990026520 Department of the Navy, Washington, DC USA
Imaging Lidar-Based Aim Verification Method and System
Cordes, Brett, Inventor; Nov. 03, 1998; 7p; In English; Supersedes US-Patent-Appl-SN-898361
Patent Info.: Filed 22 Jul. 97,; US-Patent-5,831,724; US-Patent-Appl-SN-898,361
Report No.(s): AD-D019230; No Copyright; Avail: US Patent and Trademark Office, Microfiche

An aim verification method and system utilize an imaging lidar that transmits a first beam of radiation within the imaging lidar's field of view. Reflected backscattered energy associated with the first beam within the field of view increases in an area thereof when a target is present therein. A radiation source is coupled to a gun and transmits a second beam of radiation in line with the aimpoint of the gun towards the area of increased reflected backscattered energy associated with the first beam. The second beam has a greater energy density than the first beam and has a cross-section that is smaller than the target. An energy detector is used to sense the reflected backscattered energy associated with the second beam. The gun is aimed at the target when the reflected backscattered energy associated with the second beam is greatest in the area of the field of view of increased reflected backscattered energy associated with the first beam.
DTIC
Optical Radar; Field of View; Imaging Techniques; Radiation Sources; Images

19990026598 Department of Energy, Office of Energy Research, Washington, DC USA
Gamma Ray and Neutrino Detector Facility (GRANDE): Task C ***Progress Report***
Sobel, H. W., Department of Energy, USA; Yodh, G. B., Department of Energy, USA; Aug. 31, 1991; 23p; In English
Report No.(s): DE98-006388; DOE/ER/71019-T4; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

GRANDE is an imaging, water Cerenkov detector, which combines in one facility an extensive air shower array and a high-energy neutrino detector. The authors proposed that the detector be constructed in phases, beginning with an active detector area of 31,000 m(sup 2) (GRANDE-I) and expanding to a final size of 100,000--150,000 m(sup 2). Some of the characteristics of GRANDE-I are shown. GRANDE utilizes the proven technology of water Cerenkov detectors. A feasibility study has shown that the powerful background discrimination inherent in the directional property of the Cerenkov light and in the large size of the detector, will allow successful surface operation with an acceptably small trigger rate. The engineering analysis showed that the facility can be built over the reasonably short time span of 4 years using well- known construction technologies. Combining the neutrino detector and the extensive air shower array in a single facility greatly enhances the physics potential of GRANDE. It also achieves a considerable saving in cost and time since a sizable fraction of such costs, for either experiment, is in the site preparation. Additionally, the neutrino detector benefits from the efficient cosmic-ray anticoincidence afforded by the gamma detector. A site has been selected (a water-filled quarry near Little Rock, Arkansas) and an engineering firm has completed the preliminary design of the detector structure. They also have designed the water purification system, and have preliminary designs for the data harvesting electronics and other systems. During this past year the authors learned that the proposal to construct GRANDE-I was not approved by DOE. The construction of such a detector was considered premature by the reviewers and one major technical concern still dominated the reviews. In order to answer the technical concerns while waiting for the results from the current generation of gamma-ray detectors, they propose to construct and operate a small prototype of the GRANDE detector.
NTIS
Research Facilities; Imaging Techniques; Neutrinos; Gamma Ray Spectrometers; Feasibility

19990026635 Department of the Navy, Washington, DC USA
Method for Optimization of Element Placement in a Thinned Array
O'Neill, Daniel J., Inventor; Jun. 30, 1998; 9p; In English; Supersedes US-Patent-Appl-SN-536310, AD-D017791.
Patent Info.: Filed 14 Sep. 95,; US-Patent-5,774,690; US-Patent-Appl-SN-536,310
Report No.(s): AD-D019254; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A method for generating a thinned array having an optimal directional response wherein an initial population of possible element occupancy patterns is generated and a relative fitness value for each of the element occupancy patterns in the initial population is determined. Successive populations are generated by manipulating the element occupancy patterns using reproduction, crossover, mutation, elitism, and equality operators. The array response of each occupancy pattern in the successive population is evaluated to determine a fitness value for each. The process of generating and evaluating successive populations is repeated for a specified number of generations, until the maximum population fitness does not significantly increase between generations, or until the population diversity decreases.
DTIC
Signal Processing; Mutations

19990026638 Department of the Navy, Washington, DC USA
Method of Magnetic Source Localization Using Gradient Tensor Components and Rate Tensor Components
Wynn, William M., Inventor; Jul. 07, 1998; 16p; In English; Supersedes US-Patent-Appl-SN-668453
Patent Info.: Filed 3 Jun. 96,; US-Patent-5,777,477; US-Patent-Appl-SN-668,453
Report No.(s): AD-D019257; No Copyright; Avail: US Patent and Trademark Office, Microfiche

Method and apparatus for localization and characterization of a magnetic source including source strength and orientation. Samples of five tensor gradiometer signals from a straight-line track are used to construct a polynomial fit to each gradient tensor component with the variable being either time or track distance. Polynomial expressions are used to estimate rate of change of each gradient tensor component at the current sample, providing five numbers. Current samples of the gradient tensor components form a second five number set. An invention inversion process produces solutions for instantaneous bearing vector from the gradiometer to the source, direction in space of the source magnetic moment vector, and ratio of the magnetic moment vector magnitude to the fifth power of range from gradiometer to source from the gradient tensor component rate samples. The process produces one to four solutions for the indicated source parameters, with an additional one to four solutions obtained by reflection of the bearing vector through an origin located at the gradiometer, with the associated moment vector directions remaining unchanged. Solutions resulting are applied to magnetic source localization. Gradient tensor information is independently processed using the Frahm-Wynn inversion algorithm, to produce multiple solutions for bearing vector, direction of the magnetic moment vector, and ratio of the moment vector magnitude to the fourth power of the range. The two solution sets are merged, producing a unique solution for source position vector and magnetic moment vector for each successive location of the tensor gradiometer.
DTIC
Magnetic Fields; Position (Location); Bearing (Direction); Gradients

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LASERS AND MASERS

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

19990025235 NASA Goddard Space Flight Center, Greenbelt, MD USA
Continuous-Wave Single-Frequency Operation of Fabry-Perot Laser Diodes by Self-Injection Phase Locking Using Feedback from a Fiber Bragg Grating
Duerksen, Gary L., Maryland Univ., USA; Krainak, Michael A., NASA Goddard Space Flight Center, USA; 1998; 12p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Single-frequency operation of uncoated Fabry-Perot laser diodes is demonstrated by phase- locking the laser oscillations through self-injection seeding with feedback from a fiber Bragg grating. by precisely tuning the laser temperature so that an axial-mode coincides with the short-wavelength band edge of the grating, the phase of the feedback is made conjugate to that of the axial mode, locking the phase of the laser oscillations to that mode.
Author
Continuous Radiation; Semiconductor Lasers; Injection Locking; Axial Modes; Oscillations

19990025478 Naval Academy, Annapolis, MD USA
Tunable laser light source
Schillinger, Ian J.; Jan. 1998; 66p; In English
Report No.(s): AD-A359143; USNA-258; USNA-1531-2; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A laser diode and a fiber Bragg grating can be used to construct a tunable laser light source. This new tunable laser has a central wavelength of 682.6 nm (red light) and a bandwidth less than one twentieth of one nanometer. It is tunable over a range greater than five nanometers. Tunable light sources have applications in fundamental research such as noise studies in optical amplifiers and high precision spectroscopy, as well as applications in optical engineering, including communications and LIDAR systems. Although tunable lasers exist for these purposes now, this new tunable laser has an unique construction. It contains a laser diode, which is a semiconductor pn junction diode that emits coherent light once a sufficient drive current is supplied, and an in-fiber Bragg grating that is used to modify the output of the laser diode. The grating provides additional feedback to the laser diode at the wavelength of the grating's Bragg condition. The combined system lasers at this wavelength. Tuning is accomplished by straining the grating within its fiber and thus changing the wavelength of its Bragg condition. This strain is evolved by embedding the grating in a composite beam and deflecting the beam.
DTIC
Tunable Lasers; Gratings; Coherent Light; Semiconductor Junctions

19990025483 New Mexico Univ., Dept. of Physics and Astronomy, Albuquerque, NM USA

Phased High-Power Laser Transmission Through Optical Fiber Cables ***Final Report, 26 Jan. 1996 - 25 Oct. 1998***

Moore, Gerald T., New Mexico Univ., USA; Oct. 25, 1998; 10p; In English

Contract(s)/Grant(s): F29601-96-K-0027; AF Proj. 3326

Report No.(s): AD-A358834; 3-45981; AFRL-DE-PS-TR-1998-1062; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The research carried out under this contract included the development and modeling of solid-state optical sources, including devices based on optical parametric oscillation, Raman oscillation, and harmonic generation. Devices pumped by solid-state lasers and using multiple stages of nonlinear frequency conversion were studied. Regimes of operation offering extended tuning ranges, multiple wavelength generation, high efficiency, or low threshold were identified. This research also included modeling of solid-state lasers, such as Tm:YAG, Yb:YAG, and upconversion fiber lasers, as well as studies of dynamical instabilities in semiconductor lasers.

DTIC

High Power Lasers; Transmission; Optical Fibers; Fiber Optics; Fiber Lasers

19990025488 Leeds Univ., UK

Pr(3+) -doped fluoride glass for a 589 nm fibre laser ***Final Report, 1 Jul. - 31 Dec. 1998***

Jha, Animesh, Leeds Univ., UK; Dec. 31, 1998; 9p; In English

Contract(s)/Grant(s): F61775-98-WE113

Report No.(s): AD-A358874; EOARD-SPC-98-4074; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This report results from a contract tasking University of Leeds as follows: The contractor will identify the preferred fluoride glass host for the 589nm Pr+3 doped fiber laser, carry out a full optical and spectroscopic characterization of the Pr+3 doped glass, model the lasing behaviour at 589nm, and produce a small number of glass rods suitable for fibre drawing and gain measurements.

DTIC

Fiber Lasers; Glass; Fluorides; Laser Materials; Argon Lasers; Glass Lasers; Fiber Optics; Praseodymium; Hf Lasers

19990025754 New Mexico Univ., Albuquerque, NM USA

The TI:Sapphire Ring Laser Gyroscope

Bohn, Matthew J.; Jan. 07, 1999; 153p; In English

Report No.(s): AD-A359038; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This dissertation studied the Ti:sapphire laser as a pulsed ring laser gyroscope. Several new cavity designs were demonstrated, including a saturable absorber mode-locked laser gyroscope, a linear cavity laser, a Kerr-lens mode-locked femtosecond laser gyroscope, and a solid-state mutual Kerr-lens mode-locked ring gyroscope. A solid-state ring laser gyroscope using a dye-jet saturable absorber was studied for the first time. This laser produced the lowest beat frequencies recorded in a pulsed laser (10 Hz with a 10 Hz bandwidth) and also the narrowest beat note bandwidth at 0.85 Hz. This low beat frequency bandwidth corresponds to a nonreciprocal change in optical path length of 7x10(exp -15) meters. A sensitive technique to measure the intensity dependent refractive index, n2, was developed using this laser. Null-bias dithering was demonstrated for the first time using an electro-optic modulator. A new method of extracting the average beat frequency from a dithered laser was discovered and the experimental result was verified with an analytic solution. A novel linear cavity with two pulses in the cavity was used for the first time to measure electro-optic coefficients. This laser can be analyzed as an extremely elongated ring laser with the difference being that the pulses are indistinguishable which implies no bias beat frequency. Kerr-lens mode-locking was demonstrated for the first time in a ring laser gyroscope. This laser employed both passive negative and positive feedback in the same Kerr element. Both continuous wave operation and Q-switched mode-locked operation were demonstrated without lock-in. A novel method of stabilizing the crossing point in a ring laser was demonstrated by using mutual Kerr-lens mode-locking which resulted in a bidirectional, solid-state ring laser. Finally a bidirectional OPO ring gyroscope was designed.

DTIC

Analysis (Mathematics); Bandwidth; Beat Frequencies; Bias; Cavities; Coefficients; Continuous Radiation

19990025907 Department of Energy, Washington, DC USA
Numerical Investigation of Leaky-Mode Coupling in VCSELs
Hadley, G., Department of Energy, USA; Dec. 31, 1997; 6p; In English; 1998 Victoria
Report No.(s): DE98-001487; SAND-97-3048C; CONF-980323; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

We investigate various aspects of leaky-mode coupling behavior in Vertical- Cavity Surface-Emitting Lasers (VCSELs) using a 2D finite difference model to simulate two coupled pixels. Phase-locking is shown to occur in a manner consistent with previous simple models.
NTIS
Coupled Modes; Lasers

19990025919 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
Diode Laser-Based Measurements of Hydrogen Fluoride Gas During Chemical Suppression of Fires ***Final Report, Sep. 1997 - Mar. 1998***
McNesby, Kevin L.; Skaggs, R. Reed; Miziolek, Andrzej W.; Clay, Micheal; Hoke, Steven H.; Sep. 1998; 29p; In English
Report No.(s): AD-A359407; ARL-TR-1785; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Near-infrared tunable diode laser (NIR-TDL) spectroscopy is used to quantify hydrogen fluoride (HF) gas produced during fire-suppressant testing of Halon alternatives. Results of comparisons with other techniques for measuring HF gas concentrations are discussed. Measurements of HF gas produced in laboratory- and real-scale fire-suppression testing are presented. The necessity for time-resolved measurements during testing of suppression systems designed to scavenge HF gas is demonstrated.
DTIC
Semiconductor Lasers; Gas Composition; Hydrofluoric Acid; Diodes

19990026068 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Predicting threshold laser beam irradiances for melting and welding
Leong, K. H., Department of Energy, USA; Geyer, H. K., Department of Energy, USA; Sabo, K. R., Department of Energy, USA; Sanders, P. G., Department of Energy, USA; Sep. 30, 1997; 10p; In English; 16th; Applications of Laser and Electro-Optics, USA
Report No.(s): DE98-000648; ANL/TD/CP-93140; CONF-971149; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A model based on conservation of energy for a moving heat source incident on a flat plate is used to predict the threshold laser beam irradiance required to initiate melting on a metal surface. With the use of a nondimensional variable and its solution, the threshold irradiance can be predicted with the use of a simple equation that is a function of the absorptivity of the surface, thermal conductivity of the metal, temperature increase for melting, diameter of the laser beam at the surface and the nondimensional variable value for the ratio of the thermal diffusivity of the metal to the product of the beam diameter and velocity used. Laser beam irradiances exceeding these predicted values are required for welding. The model predictions are validated with experimental results of beam irradiances required for welding different metals.
NTIS
Laser Welding; Melting; Irradiance; Laser Beams; Metal Surfaces; Flat Plates; Metals

19990026069 Joint Publications Research Service, Arlington, VA USA
JPRS Report: Science and Technology. China: Gallium Arsenide Laser Diodes
Aug. 06, 1990; 77p; In English
Report No.(s): AD-A343104; JPRS-CST-90-020; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Foreign Broadcast Information Service (FBIS) and Joint Publications Research Service (JPRS) publications contain political, military, economic, environmental, and sociological news, commentary, and other information, as well as scientific and technical data and reports. All information has been obtained from foreign radio and television broadcasts, news agency transmissions, newspapers, books, and periodicals. Items generally are processed from the first or best available sources. Items from foreign language sources are translated; those from English-language sources are transcribed. This report contains information on the china's Gallium Arsenide Laser Diode technology.
CASI
Research and Development; Semiconductor Lasers; China; Gallium Arsenides; Semiconductor Diodes

19990026127 Department of Energy, Office of Energy Research, Washington, DC USA

Diode Laser System for Synchronous Photoinjection

Poelker, M., Department of Energy, USA; Dec. 31, 1997; 8p; In English; 7th; Polarized Gas Targets and Polarized Beams, Unknown

Report No.(s): DE98-000734; DOE/ER/40150-1187; CONF-970894; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A laser system, which is composed of a gain switched diode seed laser and a single-pass diode optical amplifier, is used to drive the polarized electron source at Jefferson Lab. The system emits pulsed laser light synchronized to the accelerating cavity radio frequency (rf) at 1497 MHz or the third subharmonic, 499 MHz. The maximum average output power from the laser system is 500 mW and the optical pulse width is 60 to 80 ps. The laser system is compact and very reliable operating remotely for many days without attention.

NTIS

Semiconductor Lasers; Pulsed Lasers; Light Amplifiers; Light Beams

19990026156 Leeds Univ., Dept. of Materials, UK

Cr3+-Doped Vibronic Laser In Fluoroaluminate Glass ***Final Report, 1 Aug. - 30 Oct. 1998***

Jha, Animesh, Leeds Univ., UK; Oct. 30, 1998; 6p; In English

Contract(s)/Grant(s): F61775-98-WE113

Report No.(s): AD-A358853; EOARD-SPC-98-4075; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This report results from a contract tasking University of Leeds as follows: The contractor will investigate the possibilities for a Cr(3+) doped glass fibre laser, which may be fluoride, oxyfluoride, or oxide, and will be a vibronic laser tunable over a broad band that will enable single step frequency doubling to 589nm or direct generation of 589nm.

DTIC

Oxyfluorides; Laser Materials; Lasers; Oxides

19990026208 Department of Energy, Office of Energy Research, Washington, DC USA

Investigation of beam alignment monitor technologies for the LCLS FEL undulator

Hettel, R., Department of Energy, USA; Carr, R., Department of Energy, USA; Field, C., Department of Energy, USA; Martin, D., Department of Energy, USA; Jun. 30, 1998; 9p; In English; 8th; Beam Instrumentation, 1998, Unknown

Report No.(s): DE98-059236; SLAC-PUB-7850; CONF-980573; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

To maintain gain in the 100 m long linac-driven Linac Coherent Light Source (LCLS) FEL undulator, the electron and photon beams must propagate colinearly to within -5 micro-m rms over distances comparable to the 11.7 m FEL gain length in the 6 mm diameter undulator vacuum chamber. The authors have considered a variety of intercepting and non-intercepting position monitor technologies to establish and maintain this beam alignment. They present a summary discussion of the applicability and estimated performance of monitors detecting synchrotron radiation, transition and diffraction radiation, fluorescence, photoemission or bremsstrahlung from thin wires, Compton scattering from laser beams, and image currents from the electron beam. They conclude that: (1) non-intercepting RF cavity electron BPMs, together with a beam based alignment system, the best suited for this application; and (2) insertable intercepting wire monitors are valuable for rough alignment, for beam size measurements, and for simultaneous measurement of electron and photon beam position by detecting bremsstrahlung from electrons and diffracted x-rays from the photo beam.

NTIS

Free Electron Lasers; Linear Accelerators; Light Sources; Laser Beams; Photoelectric Emission; Photon Beams; Coherent Light; Bremsstrahlung; Diffraction Radiation; Electron Beams

19990026285 Department of Energy, Office of Energy Research, Washington, DC USA

Linac Coherent Light Source (LCLS) design study report

Apr. 30, 1998; 300p; In English

Report No.(s): DE98-059292; SLAC-R-521; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Stanford Linear Accelerator Center (SLAC), in collaboration with Los Alamos National Laboratory, Lawrence Livermore National Laboratory, and the University of California at Los Angeles, is proposing to build a Free-Electron-Laser (FEL) R and D facility operating in the self-amplified spontaneous emission (SASE) mode in the wavelength range 1.5--15 (angstrom). This FEL, called Linac Coherent Light Source (LCLS), utilizes the SLAC linac and produces sub-picosecond pulses of short wavelength xrays with very high peak brightness and full transverse coherence. In this report, the Design Team has established

performance parameters for all the major components of the LCLS and developed a layout of the entire system. Chapter 1 is the Executive Summary. Chapter 2 (Overview) provides a brief description of each of the major sections of the LCLS, from the rf photocathode gun, through the experimental stations and electron beam dump. Chapter 3 describes the scientific case for the LCLS. Chapter 4 provides a review of the principles of the FEL physics that the LCLS is based on, and Chapter 5 discusses the choice of the system's physical parameters. Chapters 6 through 10 describe in detail each major element of the system. Chapters 11 through 13 respectively cover undulator controls, mechanical alignment, and radiation issues.
NTIS
Coherent Light; Free Electron Lasers; Light Sources; Linear Accelerators; Electron Beams

19990026341 Department of Energy, Office of Energy Research, Washington, DC USA
Design of an x-ray free electron laser undulator
Carr, R., Department of Energy, USA; Sep. 30, 1997; 7p; In English; 10th; Synchrotron Radiation Instrumentation, 1997, USA
Report No.(s): DE98-059141; SLAC-PUB-7651; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

An undulator designed to be used for an x-ray free electron laser has to meet a set of stringent requirements. With no optical cavity, an x-ray FeL operates in the single pass Self Amplified Spontaneous Emission (SASE) mode; an electron macropulse is microbunched by an undulator and the radiation it creates. The microbunched pulse emits spontaneous radiation and coherent FEL radiation, whose power may reach saturation in a sufficiently long and perfect undulator. The pulse must have low emittance and high current, and its trajectory in the undulator must keep the radiation and the pulse together with a very high degree of overlap. The authors shall consider the case of the Linear Coherent Light Source (LCLS) FEL project at SLAC, which is intended to create 1.5 (angstrom) x-rays using an electron beam with 15 GeV energy, 1.5 pi mm-mrad normalized emittance, 3,400 A peak current, and 280 fsec FWHM bunch duration. They find that this 65 micro-m rms diameter beam must overlap its radiation with a walkfoff of no more than 5 micro-m for efficient gain. This places severe limitations on the magnetic field errors and other mechanical tolerances. The following is a discussion of the undulator design, specifications, alignment, engineering, and beam position monitoring they plan to implement for the LCLS X-ray FEL.
NTIS
Free Electron Lasers; Wiggler Magnets; Beams (Radiation); Electron Beams; Spontaneous Emission; X Ray Lasers

19990026385 Department of Energy, Washington, DC USA
Performance of a diode-end-pumped Yb:YAG laser
Bibeau, C., Department of Energy, USA; Beach, R., Department of Energy, USA; Ebbers, C., Department of Energy, USA; Emanuel, M., Department of Energy, USA; May 01, 1997; 6p; In English; 1997 Diode Laser Technical Review, 1997, USA
Report No.(s): DE98-050861; UCRL-JC-127284; CONF-9706220; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Using an end-pumped technology developed at LLNL we have demonstrated a Yb:YAG laser capable of delivering up to 434 W of CW power and 280 W of Q- switched power. In addition, we have frequency doubled the output to 515 nm using a dual crystal scheme to produce 76 W at 10 kHz in a 30 ns pulse length.
NTIS
Solid State Lasers; Conferences; YAG Lasers; Diodes; Performance Tests

19990026386 Department of Energy, Washington, DC USA
Simulations of laser imprint for Nova experiments and for ignition capsules
Weber, S. V., Department of Energy, USA; Glendinning, S. G., Department of Energy, USA; Kalantar, D. H., Department of Energy, USA; Key, M. H., Department of Energy, USA; Remington, B. A., Department of Energy, USA; Nov. 08, 1996; 31p; In English; Plasma Physics, USA; Sponsored by American Physical Society, USA
Report No.(s): DE98-050763; UCRL-JC-124547; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In direct drive ICF, nonuniformities in laser illumination seed ripples at the ablation front in a process called imprint. These non nonuniformities grow during the capsule implosion and, if initially large enough, can penetrate the capsule shell, impede ignition, or degrade burn. Imprint has been simulated for recent experiments performed on the Nova laser at LLNL examining a variety of beam smoothing conditions. Most used laser intensities similar to the early part of an ignition capsule pulse shape, I = 10 x 13 W/cu cm. The simulations matched most of the measurements of imprint modulation. The effect of imprint upon National Ignition Facility (NIF) direct drive ignition capsules has also been simulated. Imprint is predicted to give modulation comparable to an intrinsic surface finish of 10 nm RMS. Modulation growth was examined using the Haan model, with linear growth as a function of spherical harmonic mode number obtained from an analytic dispersion relation. Ablation front amplitudes are predicted to become substantially nonlinear, so that saturation corrections are large. Direct numerical simulations of two- dimensional multi-

mode growth were also performed. The capsule shell is predicted to remain intact, which gives a basis for believing that ignition can be achieved.
NTIS
Conferences; Simulation; Lasers; Ripples; Ablation; Nonlinearity

19990026402 Department of Energy, Washington, DC USA
National Ignition Facility final optics assembly thermal effects of maintenance operations
Parietti, L., Department of Energy, USA; Martin, R. A., Department of Energy, USA; Apr. 30, 1998; 44p; In English
Report No.(s): DE98-006024; LA-13435-MS; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The National Ignition Facility (NIF), the world's most powerful laser system, is being built at Lawrence Livermore National Laboratory (LLNL) to study inertial fusion and high-energy-density science. This billion-dollar facility consists of 192 beams focusing 1.8 MJ on a fusion target. The Final Optics Assembly (FOA), the last mechanical apparatus before the target chamber, converts the light from an incoming frequency of 1 (omega) to ia target-ready 3 (omega), and focuses the laser beam. The performance of the frequency conversion crystals is very sensitive to temperature changes; crystal temperature must be maintained within a 0.1 C of a nominal temperature prior to a laser shot. Maximizing system availability requires minimizing thermal recovery times after thermal disturbances occurring in both normal and maintenance operations. To guide the design, it is important to have estimates of those recovery times. This report presents Computational Fluid Dynamics (CFD) design calculations to evaluate thermal effects of maintenance operations.
NTIS
Temperature Dependence; Research Facilities; Fabrication; Lasers; Ignition Systems; Optical Equipment; Computational Fluid Dynamics

19990026427 Norwegian Defence Research Establishment, Kjeller, Norway
Use of a Laser Rangefinder in the FFI Measurement Radar ***Bruk av Laser Avstandsmaler I FFIS Maleradar***
Terje, Johnsen, Norwegian Defence Research Establishment, Norway; Tor, Hoimyr, Norwegian Defence Research Establishment, Norway; Oct. 19, 1998; 34p; In Norwegian
Report No.(s): FFI/Rapport-98/05245; FFIVM/666/134; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A laser rangefinder of type SIMRAD LA7N has been included in the instrumentation of the FFI measurement radar. It's main purpose is to measure target ranges which subsequentially are fed into the positioning system of the radar. to interface the laser to a computer an interface was built to convert signals between the two serial communication standards RS232/RS485. The interface was also equipped with programmable power control as well as operation flash light indicators for security reasons. A server program has been developed to provide services to clients that need range information. The server hides all details of the server-rangefinder communication protocol from the client. Tracking algorithms have been included in the server by the use of two alternative methods: alpha-beta filtering or Kalman filtering. The behaviour of the filters were found to give satisfactory predictions with range information recorded from KNM Falk (fast patrol boat) during a circle maneuver. Predictions of range are are sent to the client (radar control program) at a frequency of 10 Hz. This information are used by the control program to adjust the radars view during a high resolution run. 'Me processing of range predictions are located on the processor where the server is resident whereas the processor executing the radar control program is left with a low burden is allows the radar to operate at a high sampling frequency.
Author
Laser Range Finders; Protocol (Computers); Algorithms; Targets; Positioning

19990026456 Department of the Navy, Washington, DC USA
Light Mixing Technique for Isolation and Amplification of Laser Signal from Background Noise Due to Scattering in Turbid Media
Swanson, Nancy L., Inventor; Jul. 14, 1998; 6p; In English
Patent Info.: Filed 26 Nov. 96,; US-Patent-Appl-SN-755,819; US-Patent-5,781,298
Report No.(s): AD-D019217; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A coherent light beam is split to form optical signals that follow separate optical paths to a light beam combiner. One optical signal is frequency modulated reference signal. The optical signal is directed to the object being detected. A light collector is arranged to collect light that has impinged upon the object. The collected light from the object and the reference signal are optically

heterodyned. The heterodyned signals are detected by a photodiode that produces electrical signal that are processed to determine the shape of the object being detected.
DTIC
Laser Beams; Coherent Light; Optical Communication

19990026458 Harvard Univ., President and Fellows, Cambridge, MA USA
Solid-State Laser Source of Tunable Narrow-Bandwidth Ultraviolet Radiation
Goldberg, Lew; Kliner, Dahv A.; Koplow, Jeffrey P.; Apr. 28, 1998; 11p; In English
Patent Info.: US-Patent-Appl-SN-640,568; US-Patent-5,745,284
Report No.(s): AD-D019219; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A solid-state laser source of tunable and narrow-bandwidth UV light is disclosed. The system relies on light from a diode laser that preferably generates light at infrared frequencies. The light from the seed diode laser is pulse amplified in a light amplifier, and converted into the ultraviolet by frequency tripling, quadrupling, or quintupling the infrared light. The narrow bandwidth, or relatively pure light, of the seed laser is preserved, and the pulse amplifier generates high peak light powers to increase the efficiency of the nonlinear crystals in the frequency conversion stage. Higher output powers may be obtained by adding a fiber amplifier to power amplify the pulsed laser light prior to conversion.
DTIC
Solid State Lasers; Ultraviolet Radiation; Laser Outputs; Ultraviolet Detectors

19990026459 Department of the Navy, Washington, DC USA
Laser Diode Power Combiner
Scheps, Richard, Inventor; Jun. 09, 1998; 5p; In English
Patent Info.: Filed 14 Dec. 95,; US-Patent-Appl-SN-572,828; US-Patent-5,764,677
Report No.(s): AD-D019220; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A laser diode power combiner comprises a dye laser operably coupled to an array of laser diodes for combining optical power from the laser diodes into a single, coherent laser beam.
DTIC
Semiconductor Lasers; Masers; Coherent Radiation; Diodes

19990026606 Princeton Univ., NJ USA
(DURIP 95) Instrumentation for Phase Modulation, Stability and Control in Terabit per Second Optical Network ***Final Report, 1 Sep. 1995 - 31 Aug. 1997***
Warren,; Mar. 02, 1998; 5p; In English
Contract(s)/Grant(s): F49620-95-1-0511; AF Proj. 3484
Report No.(s): AD-A359829; AFRL-SR-BL-TR-98-0234; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We requested instrumentation (principally lasers and amplified components operating at 1.5 micrometer) to enhance a research program to develop and demonstrate a Tb/s optical network architecture. This ultra high speed architecture, which includes ultra-high parallelism and complete control over optical phase, is based on several novel optical and optoelectronic technologies such as acousto-optic spectral encoding of femtosecond optical pulses using shaped radiofrequency pulses and all-optical time-division multiplexing and demultiplexing of picosecond optical pulses. These key technologies enable an optical network architecture based on a combination of wavelength-time-and code-division multiplexing with rapid channel access and several Tb/s aggregate throughput.
DTIC
Acousto-Optics; Architecture (Computers); Lasers; Time Division Multiplexing; Optical Data Processing

19990026612 Massachusetts General Hospital, Boston, MA USA
Development of an Automated Laser System for Burn Therapy
Parrish, John A.; May 1998; 66p; In English
Contract(s)/Grant(s): DAMD17-94-C-4009
Report No.(s): AD-A359845; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Substantial progress was made in the development of a diagnostic system capable of assessing the extent of burn injury and a laser-based debridement system that rapidly, precisely and bloodlessly removes burn eschar under automatic feedback control. An ICO fluorescence imager was constructed and shown to be successful in assessing burn depths in small and large animals. The distribution of ICG into burns and normal tissue was also studied supporting steps in deriving segmentation algorithms. The tech-

nique was also safely used in a pilot clinical trial. Laser speckle was evaluated successfully in a Teflon phantom mimicking burns and more recently in porcine skin burns. A laser burn debridement system was constructed and tested on porcine skin burns. Burns were tangentially excised bloodlessly and equivalent percent engraftment rates and Vancouver scar scores were obtained from laser debrided sites and sharply excised controls. Progress has been made in developing a feedback control mechanism for controlling the laser debridement system. Identifying the transition zone between burn eschar and underlying healthy tissue appears possible using reflectance spectroscopy. Finally, a more elegant laser debridement burn diagnostic robotic system has been designed via a cooperative research agreement with Sandia National laboratories.
DTIC
Laser Applications; Burns (Injuries); Medical Equipment

19990026616 Naval Postgraduate School, Monterey, CA USA
Improved Laser Vibration Radar
Hilaire, Pierre; Dec. 1998; 55p; In English
Report No.(s): AD-A359857; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The Naval Postgraduate School Physics Department is investigating the feasibility of identifying ground combat vehicles by measuring their frequency of vibrations. This thesis reconfigured an existing CO2 laboratory laser radar system that is capable of measuring the frequencies of vibration of a simulated target into a more compact and rugged form for field testing. The optical performance of the laboratory laser radar system was also improved with a combination half-wave plate, brewster-angle plate, and quarter-wave plate. The new device was tested under laboratory conditions using a target with known frequencies of vibration and a target with a more complex frequency spectrum. Both tests involved illuminating the targets with the laser beam. The first target was a retro-reflector driven by a piezoelectric actuator vibrating at selectable known frequencies (typically 400 Hz). The second target was a 9-volt DC motor supplied with 10 volts and 13 volts respectively in order to vary its speed. The laser radar proved capable of detecting the first target's frequencies of vibrations and the more complex frequency spectrum of the DC motor.
DTIC
Carbon Dioxide Lasers; Optical Radar; Vibration; Surface Vehicles; Acousto-Optics; Field Tests

37
MECHANICAL ENGINEERING

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

19990025335 Civil Aeromedical Inst., Oklahoma City, OK USA
Comparison of Buckle Release Timing for Push-Button and Lift-Latch Belt Buckles ***Final Report***
Gowdy, Van, Civil Aeromedical Inst., USA; George, Mark, Civil Aeromedical Inst., USA; McLean, G. A., Civil Aeromedical Inst., USA; February 1999; 12p; In English
Report No.(s): DOT/FAA/AM-99/5; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Small aircraft passenger restraint systems most commonly use lift-latch type buckle release mechanisms. Push-button buckle release mechanisms, similar to those used in contemporary automobiles, have rarely been used on passenger restraints. Although push-button buckles are not explicitly prohibited by Federal Aviation Administration (FAA) regulations, the human factors aspects of introducing push-button buckles in an aircraft environment are important considerations from the standpoint of safety. A test program was conducted by the FAA Civil Aeromedical Institute (CAMI) with volunteer human subjects to measure and compare the times it takes a passenger to release a push-button buckle on a 3-point restraint, a common lift-latch buckle on a 3-point restraint, and a lift-latch buckle on a common lap belt. Sixty subjects were tested in a repeated-measures counterbalanced test protocol, which included instrumentation to measure the response times to release the buckle. Response time for the subjects to exit the seat and press a remote button was also acquired. This report includes the physical profiles of the subjects, the test protocol, and a statistical summary of the results. Based on the data acquired in this project, there was no major difference in the response times of the human subjects to release or egress from a 3-point restraint with a push-button buckle, compared with a lift-latch buckle on a 3-point or a common lap belt restraint. This study was intended to address factors associated with the use of push-button buckles restraint systems in small airplanes. Any consideration of the use of push-button buckles on commercial transport aircraft passenger seats should include data on a broader range of human factors.
Author
Seat Belts; Commercial Aircraft; Safety; Aircraft Compartments; Regulations; Human Factors Engineering; Responses

19990025451 NASA Goddard Space Flight Center, Greenbelt, MD USA

A Spaceflight Magnetic Bearing Equipped Optical Chopper with Six-Axis Active Control

Blumenstock, K. A., NASA Goddard Space Flight Center, USA; Lee, K. Y., NASA Goddard Space Flight Center, USA; Schepis, J. P., NASA Goddard Space Flight Center, USA; 1998; 11p; In English; 6th; Magnetic Bearings, 5-7 Aug. 1998, Cambridge, MA, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper describes the development of an ETU (Engineering Test Unit) rotary optical chopper with magnetic bearings. An ETU is required to be both flight-like, nearly identical to a flight unit without the need for material certifications, and demonstrate structural and performance integrity. A prototype breadboard design previously demonstrated the feasibility of meeting flight performance requirements using magnetic bearings. The chopper mechanism is a critical component of the High Resolution Dynamics Limb Sounder (HIRDLS) which will be flown on EOS-CHEM (Earth Observing System-Chemistry). Particularly noteworthy are the science requirements which demand high precision positioning and minimal power consumption along with full redundancy of coils and sensors in a miniature, lightweight package. The magnetic bearings are unique in their pole design to minimize parasitic losses and utilize collocated optical sensing. The motor is of an unusual disk-type ironless stator design. The ETU design has evolved from the breadboard design. A number of improvements have been incorporated into the ETU design. Active thrust control has been added along with changes to improve sensor stability, motor efficiency, and touchdown and launch survivability. It was necessary to do all this while simultaneously reducing the mechanism volume. Flight-like electronics utilize a DSP (Digital Signal Processor) and contain all sensor electronics and drivers on a single five inch by nine inch circuit board. Performance test results are reported including magnetic bearing and motor rotational losses.

Author

Breadboard Models; Earth Observing System (EOS); Magnetic Bearings; Prototypes; Signal Analyzers; Electric Choppers; Active Control; Aerospace Engineering; Spacecraft Equipment

19990025774 Naval Academy, Annapolis, MD USA

Active Control of Rotating Machinery Noise Through Use of Magnetic Bearings

Wiggins, John S.; Jan. 1998; 143p; In English

Report No.(s): AD-A359086; USNA-TSPR-259(1998); No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This paper investigates magnetic bearings as an actuator for noise control. The apparatus used consists of a DC motor connected to a fan blade by a short, rigid shaft supported radially and axially by magnetic bearings. The bearings provide position control of the shaft, and thus the fan blade as well. This position control was used to vibrate the fan blade as an effective speaker for producing the secondary sound in an active sound control scheme. Due to the proximity of this secondary noise source to the primary noise sources the motor and fan blade good control of low-frequency noise can be achieved at all points in space. For this project, the objective was tonal noise control at frequencies corresponding to blade rate, as indicated by tachometer feedback. Noise control algorithms such as the least mean squares algorithm were implemented on a dedicated digital signal processor, with the output translated into position commands for the magnetic bearing controller. The use of magnetic bearings as an actuator for noise control is demonstrated, with tonal noise reduction of up to 6 dB achieved. This project has application to rotating machinery and marine propulsion systems.

DTIC

Propulsion System Configurations; Propulsion System Performance; Shafts (Machine Elements); Signal Analyzers; Signal Processing; Tachometers

19990025933 South Carolina Univ., Columbia, SC USA

Full Field Strain Measurements in Welds

Duvall, Franklin T.; Jan. 1998; 76p; In English

Report No.(s): AD-A359473; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The intent of this study is to examine the stress-strain response of small material subsets in a weld subjected to some nominal loading using a full-field surface strain mapping technique. This process makes use of the digital image correlation program (VIC_2D) developed by the University of south Carolina. Full-field surface strain mapping will be used to help determine the basic material properties of the various regions within a weld, which are the heat-affected zone and the mechanically affected zone (weld nugget).

DTIC

Strain Measurement; Welded Joints; Digital Systems; Finite Element Method

19990026055 Army Communications-Electronics Command, Fort Monmouth, NJ USA

Proceedings of the Forty Seventh International Wire and Cable Symposium

Nov. 1998; 1033p; In English; 47th, 16-19 Nov. 1998, Philadelphia, PA, USA; Sponsored by International Wire and Cable Symposium, Inc., USA

Report No.(s): AD-A358377; No Copyright; Avail: CASI; A99, Hardcopy; A10, Microfiche

The International Wire and Cable Symposium provides a forum for the exchange of technical information amongst suppliers, manufacturers, and users on technological advancements in materials, processes, and products used for voice, data and video signal transmission systems.

DTIC

Data Transmission; Signal Transmission; Video Signals

19990026155 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA

Comparison of high-speed rail and maglev system costs

Rote, D. M., Department of Energy, USA; Dec. 31, 1998; 7p; In English; 15th; Maglev 1998: Magnetically levitated systems and linear drives

Report No.(s): DE98-057800; ANL/ES/CP-95537; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This paper compares the two modes of transportation, and notes important similarities and differences in the technologies and in how they can be implemented to their best advantage. Problems with making fair comparisons of the costs and benefits are discussed and cost breakdowns based on data reported in the literature are presented and discussed in detail. Cost data from proposed and actual construction projects around the world are summarized and discussed. Results from the National Maglev Initiative and the recently- published Commercial Feasibility Study are included in the discussion. Finally, estimates will be given of the expected cost differences between High-peed Rail (HSR) and maglev systems implemented under simple and complex terrain conditions. The extent to which the added benefits of maglev technology offset the added costs is examined.

NTIS

Transportation; Rails; Comparison; Magnetic Suspension

19990026244 Department of Energy, Washington, DC USA

Development of a Solid-State Resistance Weld for Joining Dual-Burst Disk Assemblies to Vessel Bodies

Kanne, W. R., Department of Energy, USA; McKinney, G. J., Department of Energy, USA; Apr. 30, 1998; 19p; In English

Report No.(s): DE98-057625; WSRC-TR-98-00109; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The objective of this program was to develop a solid-state resistance plug weld for installation of dual-burst disk assemblies in a set of tritium storage vessels. This is a cooperative effort with the Los Alamos National Laboratory. Los Alamos designed the vessels and also designed a supplied ten pairs of tests parts for development. Following development of the weld, a set of about eight vessels will be fabricated for tritium storage tests. These tests will demonstrate functioning of the dualburst disk assembly in addition to demonstrating long-term compatibility of the plug weld for tritium service.

NTIS

Solid State; Welded Joints; Pressure Vessels; Disks

19990026276 Department of the Navy, Washington, DC USA

Mechanical Water Sensor

Sanford, Matthew J., Inventor; Lewis, Keith B., Inventor; Dec. 08, 1998; 13p; In English

Patent Info.: Filed 8 Dec. 1998; US-Patent-Appl-SN-09,206,940

Report No.(s): AD-D019157; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

A water sensor includes a housing that has at least one inlet port formed therein for allowing water to pass there through when submerged in water. A drive piston is mounted in the housing for sliding engagement therein. A water-activated driver is coupled to the drive piston and is in communication with the inlet port(s). The water-activated driver is inert in air and reactive with water to exert pressure on the drive piston and so that the drive piston moves in the housing. A movable indicator is mounted relative to the housing and is positioned to be responsive to movement of the drive piston. The movable indicator moves from a first position to a second position in response to movement of the drive piston.

DTIC

Detectors; Water Pressure; Shallow Water

19990026293 California Inst. of Tech., Graduate Aeronautical Labs., Pasadena, CA USA
Round Robin Measurements of Mechanical Properties of MEMS ***Final Report, 1 May 1997 - 30 Jun. 1998***
Knauss, Wolfgang G.; Chasiotis, Ioannis; Jan. 1999; 20p; In English
Contract(s)/Grant(s): F49620-97-1-0324; AF Proj. 2302
Report No.(s): AD-A359725; SM,98-12; GALCIT,63503; AFRL-SR-BL-TR-99-0028; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A new method for tensile testing of thin films has been developed. The method employs AFM or STM acquired surface topologies of deforming specimens to determine (fields of) strains. An electrostatic grip apparatus was designed and implemented to measure the elastic and failure properties (Young's modulus, Poisson's ratio, tensile strength) of surface micromachined polysilicon specimens. The tensile specimens were "dog-bone" shaped ending in a large
DTIC
Mechanical Properties; Thin Films; Microelectronics; Digital Systems; Fracture Mechanics; Micromachining; Silicon Polymers

19990026387 Department of Energy, Washington, DC USA
Planar LIF observation of unburned fuel escaping the upper ring-land crevice in an SI engine
Green, R. M., Department of Energy, USA; Cloutman, L. D., Department of Energy, USA; Jan. 01, 1997; 21p; In English; International Congress and Exposition: Dedicated to the Advancement of the Global Mobility Industry, USA; Sponsored by Society of Automotive Engineers, Inc., USA
Report No.(s): DE98-050762; UCRL-JC-126087; CONF-970210; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

PLIF has been used to observe the in-cylinder transport of unburned fuel that, while trapped in the ring-land and ring-groove crevices, survives combustion in the propagating flame. Away from the top-ring gap, we detect a wall-jet comprised of unburned charge exiting the top ring-land crevice opening. At the location of the top-ring gap, we observed unburned fuel lying in the cool boundary layer along the cylinder wall during the later stages of the expansion stroke. This layer is scraped into the roll-up vortex during the exhaust stroke. These data lead us to conclude that away from the end gap, unburned, high pressure charge, trapped between the two compression rings escapes as a wall jet after ring-reversal near the bottom center. Conversely, at the ring gap, when the cylinder pressure drops below the pressure between the compression rings, the trapped charge escapes through the gap and forms a thin layer on the cylinder wall.
NTIS
Conferences; Combustion; Grooves; High Pressure; Wall Jets; Ignition Systems

19990026517 Department of the Navy, Washington, DC USA
Diamond Brazed to a Metal
Thorpe, Thomas P., Inventor; Snail, Keith A., Inventor; Sep. 08, 1998; 7p; In English; Supersedes , AD-D015877.
Patent Info.: Filed 30 Jul. 93,; US-Patent-Appl-SN-99,640
Report No.(s): AD-D019227; PAT-5,804,321; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A unitary article that is solid at a temperature in excess of about 110 deg C. which includes a diamond, a metal, and a brazing material brazing the diamond and the metal. The brazing material includes a metal carbide adhering to the diamond and a platinum family metal or nickel adhering to the metal. The platinum family metal has dissolved therein carbide forming metal and contains particles of metal carbide. The article is made by depositing a platinum family metal or nickel on a metal melting above the melting point of the platinum family metal or nickel, depositing a carbide forming metal which is soluble in molten platinum family metal or nickel, heating the assembly until platinum family metal or nickel is in a molten state, and cooling the molten platinum family metal or nickel to a solid state. In another embodiment, the article of this invention is made by depositing an alloy of nickel and chromium on a metal melting above the melting point of the alloy, depositing a diamond on the alloy, heating to melt the alloy, and cooling the alloy to a solid state.
DTIC
Metals; Diamonds; Carbides; Brazing

19990026676 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Dilatometry in the Gleeble: What did you really measure
Knorovsky, G. A., Department of Energy, USA; Robino, C. V., Department of Energy, USA; Dykhuizen, R. C., Department of Energy, USA; MacCallum, D. O., Department of Energy, USA; Dec. 31, 1998; 6p; In English
Report No.(s): DE98-005912; SAND-98-1404C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Gleeble is an oft-used tool for welding metallurgy research. Besides producing synthetic weld specimens, it is used to determine phase transformation temperatures and kinetics via dilatometry. Experimental data and an FEM model are used to examine measured dilatation errors because of non- uniform heating of the dilatometer and other sources such as sample elastic and plastic deformation. Both isothermal and constant heating/cooling rate scenarios are considered. Further errors which may be introduced when the dilatation is incorrectly assumed to be linearly related to the volume fraction transformed are also discussed.
NTIS
Welding; Nickel; Dilatometry; Data Acquisition; Plastic Deformation; Extensometers; Elastic Deformation

19990026720 Department of the Navy, Washington, DC USA
Ball Lock Mechanism
Dec. 15, 1998; 12p; In English
Patent Info.: Filed 15 Dec. 1998; US-Patent-Appl-SN-09/211,002
Report No.(s): AD-D019176; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche
A ball lock mechanism has a shaft with an annular groove formed therearound. A first sleeve fitted on the shaft defines at least one channel between the first sleeve and the shaft. An opening facing away from the shaft is formed at the end of each channel. Ball bearings fill each channel so that, when the channels and annular groove are misaligned, one of the bearings extends partially through each channel's opening. A second sleeve is fitted over the first sleeve and the openings for retaining the bearings in the channels. The second sleeve is configured and movable with respect to the first sleeve to push the one bearing extending partially through each channel's opening into the channel when the channels and annular groove are aligned. As a result, another of the bearings is pushed into the annular groove while remaining partially in each channel to inhibit axial movement of the shaft relative to the first sleeve.
DTIC
Locking; Ball Bearings; Grooves

38
QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

19990026289 Science Applications International Corp., San Diego, CA USA
Gamma Ray Imaging Prototype Vehicle and Cargo Inspection System (VACIS II) ***Final Report, Sep. 1997 - Sep. 1998***
Payne, Jay; Verbinski, Vic; Jan. 20, 1999; 67p; In English
Contract(s)/Grant(s): DAB63T-97-C-0055
Report No.(s): AD-A359693; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
This report summarizes the development and production of the VACIS II Gamma-ray Imaging System. It includes system specifications, a trade study, and hazard analysis.
DTIC
Scintillation Counters; Gamma Rays; Inspection; Cargo; Imaging Techniques

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.

19990025373 Southwest Research Inst., San Antonio, TX USA
Probabilistic Structural Analysis Methods (PSAM) for Select Space Propulsion System Components
January 1999; 106p; In English
Contract(s)/Grant(s): NAS3-24389; RTP 523-22-13
Report No.(s): NASA/CR-1999-208872; E-11518; NAS 1.26:208872; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
Probabilistic Structural Analysis Methods (PSAM) are described for the probabilistic structural analysis of engine components for current and future space propulsion systems. Components for these systems are subjected to stochastic

thermomechanical launch loads. Uncertainties or randomness also occurs in material properties, structural geometry, and boundary conditions. Material property stochasticity, such as in modulus of elasticity or yield strength, exists in every structure and is a consequence of variations in material composition and manufacturing processes. Procedures are outlined for computing the probabilistic structural response or reliability of the structural components. The response variables include static or dynamic deflections, strains, and stresses at one or several locations, natural frequencies, fatigue or creep life, etc. Sample cases illustrates how the PSAM methods and codes simulate input uncertainties and compute probabilistic response or reliability using a finite element model with probabilistic methods.
Author
Propulsion System Configurations; Propulsion System Performance; Fatigue Life; Structural Analysis; Structural Design; Boundary Conditions; Dynamic Loads; Finite Element Method

19990025481 Colorado State Univ., Dept. of Mechanical Engineering, Fort Collins, CO USA
Correcting a Significant and Consistent Error in the Modal Damping Obtained using Transient Vibration Data
Ratcliffe, Colin P.; Apr. 1998; 13p; In English
Report No.(s): AD-A359146; USNA-EW-2-98; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report investigates the experimental vibration technique of impact excitation when used to obtain frequency response functions. It is shown that current practices introduce a consistent error in the derived modal damping estimates. The error can be significant, with levels of damping being wrongly predicted by a factor of three or more. The report identifies the source of the error. It then derives and presents a simple correction to be applied to the observed modal damping estimates. The procedure is demonstrated by experiment.
DTIC
Vibration; Damping; Correction; Errors

19990025560 NASA Langley Research Center, Hampton,VA USA
Periodic Overload and Transport Spectrum Fatigue Crack Growth Tests of Ti62222STA and Al2024T3 Sheet
Phillips, Edward P., NASA Langley Research Center, USA; Jan. 1999; 43p; In English
Contract(s)/Grant(s): RTOP 522-18-11-01
Report No.(s): NASA/TM-1999-208995; L-17807; NAS 1.15:208995; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Variable amplitude loading crack growth tests have been conducted to provide data that can be used to evaluate crack growth prediction codes. Tests with periodic overloads or overloads followed by underloads were conducted on titanium alloy Ti-6Al-2Sn-2Zr-2Mo-2Cr solution treated and aged (Ti62222STA) material at room temperature and at 350 F. Spectrum fatigue crack growth tests were conducted on two materials (Ti62222STA and aluminum alloy 2024-T3) using two transport lower-wing test spectra at two temperatures (room temperature and 350 F (Ti only)). Test lives (growth from an initial crack half-length of 0.15 in. to failure) were recorded in all tests and the crack length against cycles (or flights) data were recorded in many of the tests. The following observations were made regarding the test results: (1) in tests of the Ti62222STA material, the tests at 350 F had longer lives than those at room temperature, (2) in tests to the MiniTwist spectrum, the Al2024T3 material showed much greater crack growth retardations due to the highest stresses in the spectrum than did the Ti62222STA material, and (3) comparisons of material crack growth performances on an ”equal weight” basis were spectrum dependent.
Author
Titanium Alloys; Aluminum Alloys; Crack Propagation; Metal Fatigue; Variable Amplitude Loading; Stress Corrosion Cracking

19990025641 Bauman Moscow State Technical Univ., Moscow, Russia
Fail-Safe Prediction of Structures Under Random Loads With Complicated Trajectories *Final Report*
Svetlitsky, Valery A., Bauman Moscow State Technical Univ., Russia; Jan. 1996; 15p; In English
Contract(s)/Grant(s): F6170-89-W-0142
Report No.(s): AD-A358986; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report results from a contract tasking Bauman State Technical University as follows: Provide methods for structural analysis of random loading given by correlation functions or spectral densities making it possible to obtain initial information about loading cycles which is necessary for assessing survivability and fatigue longevity of cracked structural elements.
DTIC
Random Variables; Procedures; Structural Analysis; Random Loads; Fail-Safe Systems; Fatigue (Materials)

19990025665 NASA Marshall Space Flight Center, Huntsville, AL USA

Quasi-Static Probabilistic Structural Analyses Process and Criteria

Goldberg, B., NASA Marshall Space Flight Center, USA; Verderaime, V., NASA Marshall Space Flight Center, USA; January 1999; 44p; In English

Report No.(s): NASA/TP-1999-209038; M-908; NAS 1.60:209038; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Current deterministic structural methods are easily applied to substructures and components, and analysts have built great design insights and confidence in them over the years. However, deterministic methods cannot support systems risk analyses, and it was recently reported that deterministic treatment of statistical data is inconsistent with error propagation laws that can result in unevenly conservative structural predictions. Assuming non-nal distributions and using statistical data formats throughout prevailing stress deterministic processes lead to a safety factor in statistical format, which integrated into the safety index, provides a safety factor and first order reliability relationship. The embedded safety factor in the safety index expression allows a historically based risk to be determined and verified over a variety of quasi-static metallic substructures consistent with the traditional safety factor methods and NASA Std. 5001 criteria.

Author

Safety Factors; Error Analysis; Structural Analysis; Systems Analysis; Risk; Reliability

19990025780 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA

Using Reinforced Earth Walls for Blast Mitigation

Pieri, Ronald L.; Dec. 03, 1998; 131p; In English

Report No.(s): AD-A359102; AFIT-FY99-28; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The purpose of this report was to assess current blast mitigation methods. Several blast mitigation walls were constructed and tested to analyze their performance against force protection criteria. The three blast mitigation walls that were tested included a Hesko-Bastion Concertainer Revetment Module, a Maccaferri FlexMac Revetment Module and a Reinforced Earth Wall using Tensar Geotextiles.

DTIC

Geotechnical Fabrics; Protection

19990025950 Naval Research Lab., Washington, DC USA

Optimimization of the Acoustic Performance of a Thick Plate with Embedded Actuators ***Final Report***

Dyka, C. T.; Kirby, G. C.; Dec. 31, 1998; 28p; In English; Prepared in cooperation with GEO-Centers Inc., Fort Washington, MD.

Report No.(s): AD-A358867; NRL/MR/6350-98-8329; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The acoustic response of a simple thick plate with embedded actuators is investigated in this work, and its performance optimized. The actuators themselves are not modeled. The plate is subjected to an incident wave and the actuators (pistons) do not necessarily cover the entire plate. A standard minimization method as well as a genetic algorithm are used to minimize the acoustic intensity of the far field at both selected field points and the entire far field. A closed form solution is derived for the case of the actuators being driven at the same velocity amplitude, while a genetic algorithm is employed to fwd optimum solutions for the actuators being driven at different velocity amplitudes. The results indicate that the closed form solution, which can include actuators functioning below 100% capacity, produces excellent solutions when the plate is mostly covered with actuators. However, for plates that are only partially covered with actuators or if some of the actuators are not firing or well below 100%, the closed form approach can produce very poor results. The genetic algorithm generate viable solutions in all cases, but shows less spectacular improvements in the reduction of the far field intensities.

DTIC

Acoustic Properties; Far Fields; Genetic Algorithms; Optimization; Pistons

19990025963 Naval Academy, Div. of Engineering and Weapons, Annapolis, MD USA

A Technique to Locate Damage in a Beam Using Non-Resonant Frequency Response Vibration Data

Ratcliffe, Colin P.; Jul. 1997; 27p; In English

Report No.(s): AD-A359124; EW-07-97; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper investigates a vibrational technique for the non destructive identification of damage in beams. There has been much work investigating the variation of natural frequencies with damage, but much less on the effect of damage on mode shapes. Very little attention has been directed to off-resonant performance. This paper develops a technique for identifying the location of structural damage in a beam using experimental frequency response function data. The procedure specifically has no requirement for knowledge about the undamaged structure. Although the technique is based on modal superposition, a modal analysis

of the measured data is not required, and offers no additional information. This work was brought about by the need to locate damage in difficult-to-reach structures such as the underwater part of offshore oil platforms, and space structures such as satellites and the space station.
DTIC
Beams (Supports); Crude Oil; Destruction; Frequency Response; Large Space Structures; Spacecraft Structures

19990025972 Minerals, Metals and Materials Society, Warrendale, PA USA
George R. Irwin Symposium on Cleavage Fracture ***Final Report***
Chan, Kwai S.; Dec. 29, 1998; 367p; In English; Presented at 1997 TMS Fall Meeting held 15-17 Sep 97 at Indianapolis, IN.
Contract(s)/Grant(s): N00014-97-1-0850
Report No.(s): AD-A358652; No Copyright; Avail: CASI; A16, Hardcopy; A03, Microfiche

This symposium was originally proposed to TMS under the title of "Cleavage Fracture: Theory, Experimentation, and Modeling." The goal of the symposium was to be an in-depth coverage of the recent work on the phenomena of cleavage fracture in the presence of plastic flow. After the initial call-for-papers went out, subsequent discussion with Professor Ronald W. Armstrong, University of Maryland, led to the dedication of this symposium to Professor George R. Irwin for his landmark contributions to the field of fracture mechanics and its applications to cleavage fracture. The George R. Irwin Symposium on Cleavage Fracture is a companion symposium to the Frank A. McClintock Symposium on ductile fracture, which was held earlier in February 1997 at the TMS Annual Meeting in Orlando, Florida. The initial response to the Irwin Symposium was overwhelming with more than sixty tentative titles submitted. Unfortunately, some authors had to withdraw later for various reasons. The final program consists of thirty-nine papers organized into five sessions, with one on the biography of Professor Irwin to be presented at the symposium banquet by Professor H. P. Rossmanith, Institute of Mechanics, Vienna University of Technology. The symposium proceedings is a collection of twenty nine papers and ten abstracts on the subjects of fracture mechanics, dislocation theory of fracture, atomistic fracture, micromechanical and microstructural modeling of cleavage, cleavage mechanisms, fractographic characterization, experimental techniques, and cleavage studies in metals, welds, intermetallics, ceramics, and minerals. The diverse topics reflect the wide range of disciplines that Professor Irwin has impacted through his pioneer work on fracture mechanics.
DTIC
Fracture Mechanics; Microstructure; Micromechanics

19990025995 Department of Energy, Washington, DC USA
Scalable computations in penetration mechanics
Kimsey, K. D., Department of Energy, USA; Schraml, S. J., Department of Energy, USA; Hertel, E. S., Department of Energy, USA; Jan. 31, 1998; 11p; In English; 4th; Large-Scale Analysis and Design on High-Performance Computers and Workstations
Report No.(s): DE98-002636; SAND-98-0254C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This paper 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 IBM SP2, the SGI Power challenge Array, and the SGI Origin 2,000. The scalability of the message-passing code on distributed-memory and symmetric multiprocessor architectures is presented and compared to the ideal linear performance.
NTIS
Penetration; Computation; Messages; Multiprocessing (Computers)

19990026116 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
The Yield Behaviour of a Structural Adhesive under Complex Loading
Ignjatovic, Mladen, Defence Science and Technology Organisation, Australia; Chalkley, Peter, Defence Science and Technology Organisation, Australia; Wang, Chun, Defence Science and Technology Organisation, Australia; Sep. 1998; 33p; In English; Original contains color illustrations
Contract(s)/Grant(s): RAAF-ASI-IA
Report No.(s): DSTO-TR-0728; DODA-AR-010-646; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

Recent developments in bonded composite repair technology at the Aeronautical and Maritime Research Laboratory (AMRL) have been in the area of repairs to curved surfaces, eg. the proposed repairs to the F/A-18 aileron hinge and the F/A-18 bulkhead crotch region. Bonded composite repairs to curved surfaces induce through-thickness stresses as well as shear stresses in the adhesive. The yield behaviour of AMRLs most common repair adhesive - FM73 - has not been investigated under such conditions of combined loading. Reported herein is a yield function for the repair adhesive FM73, based upon the Modified

Drucker-Prager/Cap Plasticity model. This yield function was selected based on experiments on a test specimen subjected to a range of combined stress states. A finite element (FE) analysis of test specimen (Iosipescu test specimen modified for adhesives) was carried out to establish its validity for obtaining data. A set of constants was obtained for the Modified Drucker-Prager/Cap Plasticity model of FM73 adhesive that enables detailed FE analyses of bonded repairs to curved surfaces.
Author
Adhesives; Loads (Forces); Yield Strength; Shear Stress; Plastic Properties; Plastic Deformation; Dynamic Structural Analysis

19990026191 Florida Univ., Graduate Engineering and Research Center, Shalimar, FL USA
The Interaction of Kinetic Energy Penetrators With Geomaterials and Concrete ***Final Report***
Ross, C. A.; Schmidt, M. J.; Cristescu, N. D.; Cazacu, O.; Jan. 1999; 72p; In English
Contract(s)/Grant(s): F49620-98-1-0090
Report No.(s): AD-A359672; AFRL-SR-BL-TR-99-0033; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A large diameter split Hopkinson pressure bar (SHPB) was used to generate dynamic shear strength and confined/unconfined compressive data for mortar. In addition quasistatic shear and compressive strength data were generated for the same mortar. The new shear specimen was modeled using finite element analysis to verify its validity. Strain rate sensitivity of the shear response of mortar is very similar to that of the tension and compression data. A new elastic/viscoplastic constitutive equation was developed for mortar. This equation, rather simple in concept and expression, captures the main features of the material response such as compressibility and dilatancy strain-hardening, influence of the loading rate and creep and relaxation. This model can be easily extended to 3-D conditions.
DTIC
Viscoplasticity; Penetration; Elastic Properties; Shear Strength; Kinetic Energy; Finite Element Method; Constitutive Equations; Concretes

19990026199 Southwest Research Inst., San Antonio, TX USA
Damage Mechanisms in High Cycle Fatigue ***Final Report, 15 Jul. 1996 - 31 Jan. 1999***
Davidson, David L.; Jan. 31, 1999; 127p; In English
Contract(s)/Grant(s): F49620-96-C-0037
Report No.(s): AD-A359744; SWRI-18-8243; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This program was designed to allow interaction between MURI investigators and Southwest Research Institute and to allow SwRI to perform independent research on high cycle fatigue mechanisms. The program goals were met. Two students performed experiments with the SwRI micromechanics facilities. Four manuscripts for publication are included in this report from the independent research effort. The results show (1) that fretting fatigue in the blade-disk attachment is a very difficult damage mechanism to understand and predict (2) the HCF/LCF interaction has a small effect on fatigue crack growth, and (3) there is still much to be learned about how microstructural variations affect fatigue crack growth mechanisms through Ti-6Al-4V. However, considerable progress was made in this program towards understanding the disk-blade attachment problem
DTIC
Fatigue (Materials); Degradation; Microstructure; Micromechanics; Cracking (Fracturing)

19990026321 Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn, Germany
Corrosion Fatigue of Structural Components
Schuetz, Walter, Industrieanlagen-Betriebsgesellschaft m.b.H., Germany; Fatigue in the Presence of Corrosion; March 1999; 9p; In English; See also 19990026320; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Corrosion fatigue is a very complex phenomenon, because two very different loading systems are acting together. In addition, its correct simulation in the lab- while relatively easy, if expensive, for fatigue alone - is nearly impossible for cost and duration reasons. Also, little is known about the corrosion environment of aircraft (and of ground vehicles). Components, always notched, behave differently from unnotched material specimens in corrosion fatigue. Therefore, materials tests are useless, it is necessary to test components, with their protection system, under the relevant variable amplitude stress-time history and to simulate also the typical sequence; Corrosion-Corrosion Fatigue-Corrosion etc., in order to obtain a result which corresponds to the real behaviour in service. This has never been done up to now - and would be very expensive anyway. One way out of this problem would be to corrosion-fatigue test components which have suffered corrosion damage in service. This has been done a number of times,

as some papers in this Workshop show. Finally a number of rules for improving corrosion fatigue tests in the lab are presented, including the suggestion to fit ”corrosion boxes” to some typical components of an aircraft during it’s full scale fatigue test.
Author
Fatigue (Materials); Corrosion; Structural Failure; Aircraft Reliability; Aircraft Maintenance; Aircraft Structures; Fatigue Tests; Full Scale Tests; Corrosion Tests; Simulation

19990026325 Institute for Aerospace Research, Ottawa, Ontario Canada
Local Stress Effects of Corrosion in Lap Splices
Komorowski, J. P., Institute for Aerospace Research, Canada; Bellinger, N. C., Institute for Aerospace Research, Canada; Gould, R. W., Institute for Aerospace Research, Canada; Fatigue in the Presence of Corrosion; March 1999; 8p; In English; See also 19990026320; Sponsored in part by NCI Information Systems; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Corrosion pillowing in fuselage joints has been modelled using finite element techniques and close-form solutions and shown to result in very high stress, which may lead to non-surface breaking high aspect ratio cracks. These cracks have been identified in a number of transport aircraft. Fractographic studies identified intergranular corrosion and in some cases fatigue striations at the crack front. Corrosion may have a greater impact on the structural integrity of joints than previously recognized and may require durability and damage tolerance reassessments including corrosion damage scenarios.
Author
Fatigue (Materials); Structural Failure; Aircraft Maintenance; Cracks; Finite Element Method; Fuselages; Intergranular Corrosion; Stress Corrosion; Transport Aircraft; Lap Joints; Splicing

19990026337 Dayton Univ. Research Inst., OH USA
Risk Assessment of Fatigue Cracks in Corroded Lap Joints
Berens, Alan P., Dayton Univ. Research Inst., USA; West, J. Doug, Boeing Defense and Space Group, USA; Trego, Angela, Boeing Defense and Space Group, USA; Fatigue in the Presence of Corrosion; March 1999; 10p; In English; See also 19990026320; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

As part of a program to develop analytical tools for predicting and validating the effects of corrosion on fatigue life assessments, deterministic crack growth predictions were made for a test specimen that is representative of a transport fuselage lap joint. Fatigue tests had been performed using this specimen and the results were made available by the National Research Council of Canada. The test data provided the necessary information to define boundary conditions, cracking scenarios, and initiating crack size distributions as well as to validate predictions. In addition to corrosion severity, which was modeled by the metric of uniform material thinning, the crack growth predictions also had to account for multiple site damage. This paper uses the lap joint specimen test data and the deterministic crack growth predictions to demonstrate a risk analysis approach for quantifying random effects of factors associated with corrosion damage. Stress intensity factors and crack growth are calculated for selected percentiles of assumed distributions of corrosive thinning. Output from these deterministic analyses are then used in the risk analysis program Probability of Fracture (PROF) to calculate conditional failure probability as a function of experienced cycles for the multiple sets of defined conditions. The results are interpreted by a comparison of risks for the various degrees of thinning and by an implied distribution of hours to reach a fixed failure probability for the assumed distributions of corrosive thinning.
Author
Fatigue Tests; Corrosion; Structural Failure; Crack Propagation; Cracks; Fatigue Life; Lap Joints; Fuselages; Fracturing

19990026410 Department of Energy, Office of Financial Management and Controller, Washington, DC USA
Crack detection on HC-130H aircraft using low frequency eddy current
Moore, D. G., Department of Energy, USA; Mihelic, J. E., Department of Energy, USA; Barnes, J. D., Department of Energy, USA; Feb. 28, 1998; 6p; In English; Sponsored by American Society for Nondestructive Testing, Inc., USA
Report No.(s): DE98-004131; SAND-98-0449C; CONF-980340; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

An eddy current inspection method was developed at the Federal Aviation Administration’s Airworthiness Assurance NDI Validation Center (AANC) to easily and rapidly detect subsurface fatigue cracks in the wheel well fairing on the US Coast Guard (USCG) HC-130H aircraft caused by fatigue. The inspection procedure locates cracks as small as 10.2 mm in length at 2.54 mm below the skin surface at raised fastener sites. The test procedure developed baseline three USCG aircraft. Inspection results on the three aircraft reveals good correlation with results made during subsequent structural disassembly.
NTIS
Cracks; Eddy Currents; Aircraft; Low Frequencies

19990026411 Department of Energy, Washington, DC USA

Use of time-resolved wave profile techniques for dynamic material property measurements -- Review and prospects for the future

Asay, J. R., Department of Energy, USA; Feb. 28, 1998; 25p; In English; 37TH; JOWOG

Report No.(s): DE98-004130; SAND-97-3095C; CONF-980218; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Shock wave techniques have become a standard tool for studying the high pressure dynamic response of materials. An important advance in this field is the development of techniques for making detailed measurements of the time-resolved wave structure in shock and release waves. These techniques began with the development of stress wave gauges in the early 1960s and have evolved into a variety of high-resolution techniques being used in present shock physics applications. This paper provides a brief review of the development and use of time-resolved interferometer techniques for studying the high pressure dynamic response of materials. Applications of these techniques include studies of the initial compressive yield response of materials, plastic viscosity occurring during shock compression, measurements of compressive and tensile yield strength after passage of strong shock waves, and measurements of the kinetic properties of phase transitions. Dynamic material properties obtained from these measurements are important in developing predictive material models important to Science Based Stockpile Stewardship and in validating the equation of state and constitutive response of material models being used in a variety of applications. Examples are given which illustrate the importance of these measurements in current weapon physics and in other non-weapon applications. Prospects for extending these techniques for use with pulsed radiation sources, such as z pinch accelerators, are also discussed.

NTIS

Time Measurement; Shock Waves; Dynamic Characteristics; Dynamic Response

19990026412 Department of Energy, Washington, DC USA

Sandia hypervelocity gun technology for validating EOS at extreme pressures and temperatures

Chhabildas, L. C., Department of Energy, USA; Furnish, M. D., Department of Energy, USA; Brannon, R. M., Department of Energy, USA; Reinhart, W. D., Department of Energy, USA; Feb. 28, 1998; 11p; In English; 37th; JOWOG

Report No.(s): DE98-004129; SAND-97-3094C; CONF-980218; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

At very high impact velocities material properties will be dominated by phase-changes, such as melting or vaporization. These phase changes are not easily attainable at typical light-gas gun velocities of 8 km/s. Development of well-controlled shock loading capabilities is the first step necessary to improve the understanding of material behavior at extreme pressures and temperatures not currently available using conventional two-stage light-gas gun techniques. In this paper, techniques that have been used to extend both the launch capabilities of a two-stage light gas gun to 16 km/s, and their use to determine the material properties at pressures and temperature states higher than those ever obtained using two-stage light-gas gun loading techniques are summarized. The newly developed hypervelocity launcher (HVL) can launch intact (macroscopic dimensions) plates to 16 km/s. Time-resolved interferometric techniques have been used to determine shock-loading/release characteristics of aluminum impacted by an aluminum flier, and shock-induced vaporization phenomena in fully vaporized zinc at impact velocities of 10 km/s. These experiments also define the maximum stress limit i.e., 200 GPa to which lithium-fluoride windows can be utilized as a laser velocity interferometer window.

NTIS

Hypervelocity Guns; Equations of State

19990026576 Norwegian Defence Research Establishment, Kjeller, Norway

Health Monitoring of Ship Hulls using Wavelets, Wavelet Packets and System Identification Techniques

Bremer, Amund Solvi, Norwegian Defence Research Establishment, Norway; Jun. 25, 1998; 144p; In English

Contract(s)/Grant(s): FFIE Proj. 711/116

Report No.(s): FFI/Rapport-98/02764; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This report was written as a diploma thesis at Forsvarets forskningsinstitutt during 1997 and 1998. The purpose of the work is to examine methods for detecting and characterizing transient structural vibrations in a ship hull. The theory of wavelets and wavelet packets is reviewed. An efficient implementation of a wavelet-based matched filter for detecting and characterizing transient vibrations is documented. As a complementary method, the possibility for using system identification methods for identifying dynamical properties of the hull is also investigated. It is shown how a state-space formulation can be a convenient way of

representing a vibrating structure. This state-space formulation can be estimated from measured data, and structural parameters such as eigenfrequencies and damping can then be extracted.
Author
Health; Procedures; Technology Assessment; Ship Hulls; Vibration; Wavelet Analysis; Structural Vibration

19990026622 Department of the Navy, Washington, DC USA
System for Monitoring Surface Stress and Other Conditions in Structures
Nadolink, Richard H., Inventor; Sep. 29, 1998; 5p; In English; Supersedes US-Patent-Appl-SN-716665, AD-D018202.
Patent Info.: Filed 17 Aug. 96,; US-Patent-Appl-SN-716,665; US-Patent-5,814,816
Report No.(s): AD-D019181; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A system for monitoring a structure is built on a printed circuit board (PCB) mounted at the surface of the structure. A piece of single crystal silicon is mounted on the PCB and is in contact with the structure. An infrared source directly illuminates the silicon while an infrared detector is focused thereon to monitor isochromatic fringe patterns projected from the silicon as a direct indication of stress at the surface. One or more other sensors are coupled to the PCB for collecting data indicative of other physical conditions experienced by the structure. A wireless system communicates with each such sensor so that the data so collected can be received at a remote location.
DTIC
Infrared Radiation; Diffraction Patterns; Printed Circuits; Data Acquisition

19990026670 Department of Energy, Assistant Secretary for Nuclear Energy, Washington, DC USA
Elastic-plastic strain acceptance criterion for structures subject to rapidly applied transient dynamic loading
Solonick, W., Department of Energy, USA; Nov. 30, 1996; 15p; In English; 1996 International Mechanical Engineering Congress and Exhibition, 1996, USA
Report No.(s): DE98-006419; KAPL-P-000034; CONF-961105; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Rapidly applied transient dynamic loads produce stresses and deflections in structures that typically exceed those from static loading conditions. Previous acceptance criteria for structures designed for rapidly applied transient dynamic loading limited stresses to those determined from elastic analysis. Different stress limits were established for different grades of structure depending upon the amount of permanent set considered acceptable. Structure allowed to sustain very limited permanent set is designed to stress limits not significantly greater than yield stress. Greater permanent set in structure under rapidly applied transient dynamic loading conditions is permitted by establishing stress limits that are significantly greater than yield stress but still provide adequate safety margin (with respect to failure). This paper presents a strain-based elastic-plastic (i.e., inelastic) analysis criterion developed as an alternative to the more conservative stress-based elastic analysis stress criterion for structures subjected to rapidly applied transient dynamic loading. The strain limits established are based on a fraction of the strain at ultimate stress obtained from an engineering stress/strain curve of the material. Strains limits are categorized by type as membrane or surface and by region as general, local, or concentrated. The application of the elastic- plastic criterion provides a more accurate, less conservative design/analysis basis for structures than that used in elastic stress-based analysis criteria, while still providing adequate safety margins.
NTIS
Stress-Strain Relationships; Design Analysis; Membranes; Safety; Static Loads; Mechanical Properties

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GEOSCIENCES (GENERAL)

19990025785 Department of Energy, Office of Energy Research, Washington, DC USA
Analysis of hydrogen isotope ratios by SIMS, and application to determining mineral-fluid isotope fractionation factors
Riciputi, L. R., Department of Energy, USA; Chacko, T., Department of Energy, USA; Cole, D. R., Department of Energy, USA; Horita, J., Department of Energy, USA; Sep. 30, 1997; 6p; In English; Secondary ion mass spectrometry
Report No.(s): DE97-008558; CONF-970933-1; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Due to the large mass difference between the two isotopes, D/H ratios can be strongly affected by chemical processes. Thus, they can be sensitive monitors of fluid source, temperature, and fluid-rock interactions in geologic settings. The lack of confidence in fractionation factors has significantly hindered realization of the potential of D/H ratios in geochemical studies. The authors

describe a new experimental method, relying on SIMS analysis, that allows the precise determination of mineral water D/H fractionation factors, and the analytical considerations that are required to make both precise and accurate measurements. The development of this method is based on the fact that diffusion rates are markedly anisotropic in many hydrous minerals, varying by over five orders of magnitude depending on the crystallographic orientation. The diffusion rates can be determined by conducting controlled exchange experiments of fixed duration using isotopically labeled waters that are enriched (strongly) with D, and then measuring the depth profile by SIMS.
NTIS
Hydrogen Isotopes; Minerals; Fractionation; Geochemistry; Isotope Ratios

19990026404 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA
Urban security ***Annual Report, 1997***
Mar. 31, 1998; 19p; In English
Report No.(s): DE98-004338; LA-UR-97-5169; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The work during fiscal year 1997 focused in an effort titled 'Urban Security -- A High-Performance Computing Pilot Project.' During this year a team was engaged representing five Laboratory divisions and a range of expertise including atmospheric and hydrologic modeling, software design, mathematics, geographic information systems (GIS), geology, and urban planning. One major part of the pilot project was to link regional atmospheric modeling with ground water models in order to assess vulnerability of urban water supplies to climate change. Another part of the pilot project was to model the transport of an airborne toxic gas, including effects of buildings on air flow, and to link this to traffic simulations for effective emergency response. Other activities were to establish connections with potential collaborators and funding agencies, as well as highlighting the project through presentations at professional meetings.
NTIS
Atmospheric Models; Urban Planning; Software Engineering; Hydrology Models; Environment Effects

19990026684 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA
BIOME: A scientific data archive search-and-order system using browser-aware, dynamic pages
Jennings, S. V., Department of Energy, USA; Yow, T. G., Department of Energy, USA; Ng, V. W., Department of Energy, USA; Aug. 31, 1997; 4p; In English; WebNet World, 1997
Report No.(s): DE97-009364; CONF-971099-1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The Oak Ridge National Laboratory's (ORNL) Distributed Active Archive Center (DAAC) is a data archive and distribution center for the National Air and Space Administration's (NASA) Earth Observing System Data and Information System (EOSDIS). Both the Earth Observing System (EOS) and EOSDIS are components of NASA's contribution to the US Global Change Research Program through its Mission to Planet Earth Program. The ORNL DAAC provides access to data used in ecological and environmental research such as global change, global warming, and terrestrial ecology. Because of its large and diverse data holdings, the challenge for the ORNL DAAC is to help users find data of interest from the hundreds of thousands of files available at the DAAC without overwhelming them. Therefore, the ORNL DAAC has developed the Biogeochemical Information Ordering Management Environment (BIOME), a customized search and order system for the World Wide Web (WWW). BIOME is a public system located at http://www-eosdis. ornl.gov/BIOME/biome.html.
NTIS
Information Management; EOS Data and Information System; Data Bases; Ecology; Biogeochemistry

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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.

19990025392 NASA Goddard Space Flight Center, Greenbelt, MD USA
Satellite Detection of Smoke Aerosols Over a Snow/Ice Surface by TOMS
Hsu, N. Christina, Raytheon STX Corp., USA; Herman, Jay R., NASA Goddard Space Flight Center, USA; Gleason, J. F., NASA Goddard Space Flight Center, USA; Torres, O., Maryland Univ. Baltimore County, USA; Seftor, C. J., Raytheon STX Corp., USA; 1998; 18p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The use of TOMS (Total Ozone Mapping Spectrometer) satellite data demonstrates the recently developed technique of using satellite UV radiance measurements to detect absorbing tropospheric aerosols is effective over snow/ice surfaces. Instead of the

traditional single wavelength (visible or infrared) method of measuring tropospheric aerosols, this method takes advantage of the wavelength dependent reduction in the backscattered radiance due to the presence of absorbing aerosols over snow/ice surfaces. An example of the resulting aerosol distribution derived from TOMS data is shown for an August 1998 event in which smoke generated by Canadian forest fires drifts over and across Greenland. As the smoke plume moved over Greenland, the TOMS observed 380 nm reflectivity over the snow/ice surface dropped drastically from 90-100% down to 30-40%. to study the effects of this smoke plume in both the UV and visible regions of the spectrum, we compared a smoke-laden spectrum taken over Greenland by the high spectral resolution (300 to 800 nm) GOME instrument with one that is aerosol-free. We also discuss the results of modeling the darkening effects of various types of absorbing aerosols over snow/ice surfaces using a radiative transfer code. Finally, we investigated the history of such events by looking at the nearly twenty year record of TOMS aerosol index measurements and found that there is a large interannual variability in the amount of smoke aerosols observed over Greenland. This information will be available for studies of radiation and transport properties in the Arctic.
Author
Aerosols; Satellite Observation; Ice; Snow; Total Ozone Mapping Spectrometer; Smoke

19990025570 Physics and Electronics Lab. TNO, The Hague Netherlands
Geographical Information Extraction With Remote Sensing, Pt. 3, Appendices ***Final Report***
vandenBroek, A. C.; vanPersie, M.; Noorbergen, H. H.; Rijckenberg, G. J.; Aug. 1998; 119p; In English
Report No.(s): AD-A359285; FEL-98-A077-PT-3; TDCK-TD98-0169; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The goal of this study is to evaluate the potential of remote sensing for geographical information extraction. We have therefore collected remote sensing data from sensors in different wavelength regions (optical, thermal infrared and microwave) and for two test sites showing a variety of geographical features. The extracted geographical information has been compared with an existing ground database (TERAS) using a selected DIGEST feature list. With resolutions of about 5 meter most features can be detected and with resolution less than 1 meter most features can be recognised. For extended features like crop land or forest spectral or polarimetric information is more important than the resolution.
DTIC
Data Bases; Extraction; Infrared Radiation; Polarimetry; Remote Sensing

19990025631 Clemson Univ., SC USA
LANDSAT and the Rise of Earth Resources Monitoring, Chapter 10
Mack, Pamela E., Clemson Univ., USA; From Engineering Science to Big Science: The NACA and NASA Collier Trophy Research Project Winners; 1998, pp. 235-250; In English; ISBN 0-16-049640-3; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In 1974, Dr John E. Clark, representing NASA, and Daniel. J Fink of General Electric received a Collier Trophy for the LANDSAT program ”for proving in 1974 the value of U.S. space technology in the management of the Earth’s resources and environment for the benefit of all mankind.” Due to political and other problems, the LANDSAT program was not as successful as it was technically capable of being. This was in part due to budget problems, and also the politics of an multi-agency project. The satellite functioned as planned, providing information of value to scientist studying agriculture, geology, land use and other fields. The Multispectral Scanner, proved particularly valuable. LANDSAT was a relatively small project, but because of its practical goals it shows particularly clearly the problems of building a constituency for big science and technology projects and the complexities involved in determining the proper role of the government in the spectrum between research and practical applications.
CASI
LANDSAT Satellites; Politics; Research and Development

19990025647 Physics and Electronics Lab. TNO, The Hague Netherlands
Geographical Information Extraction With Remote Sensing, Pt. 2, Technical Supplement ***Final Report***
vandenBroek, A. C.; vanPersie, M.; Noorbergen, H. H.; Rijckenberg, G. J.; Aug. 1998; 110p; In English
Report No.(s): AD-A359286; FEL-98-A077-PT-2; TDCK-TD98-0169; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The goal of this study is to evaluate the potential of remote sensing for geographical information extraction. We have therefore collected remote sensing data from sensors in different wavelength regions (optical, thermal infrared and microwave) and for two test sites showing a variety of geographical features. The extracted geographical information has been compared with an existing ground database (TERAS) using a selected DIGEST feature list. With resolutions of about 5 meter most features can be detected

and with resolution less than 1 meter most features can be recognised. For extended features like crop land or forest spectral or polarimetric information is more important than the resolution.
DTIC
Infrared Radiation; Microwaves; Polarimetry; Remote Sensing

19990025655 Army Cold Regions Research and Engineering Lab., Hanover, NH USA
International Conference on Snow Hydrology: The Integration of Physical, Chemical, and Biological Systems
Hardy, Janet; Albert, Mary; Marsh, Philip; Aug. 1998; 126p; In English, 6-9 Oct. 1998, Brownsville, VT, USA
Report No.(s): AD-A359332; CRREL-SP-98-10; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche; Abstracts Only; Abstracts Only

This report comprises the abstracts of all papers presented at a special four-day conference on snow hydrology held in Vermont, U.S.A., 6-9 October 1998. The purpose of this conference was to provide a forum for sharing new knowledge on snow-cover properties and processes, chemical processes in the seasonal snow cover, biotic interactions with the seasonal snow cover, distributed snowmelt models, and scaling problems in snow hydrology to encourage exchange between disciplines, papers were sought that addressed the relation between processes-physical, chemical, and biological-and the integration and distribution of these processes over different spatial and temporal scales.
DTIC
Chemical Composition; Chemical Reactions; Drainage; Hydrology; Snow Cover

19990025666 NASA Goddard Space Flight Center, Greenbelt, MD USA
Principles in Remote Sensing of Aerosol from MODIS Over Land and Ocean
Remer, L. A., NASA Goddard Space Flight Center, USA; Kaufman, Y. J., NASA Goddard Space Flight Center, USA; Tanre, D., Lille-1 Univ., France; Chu, D. A., Science Systems and Applications, Inc., USA; 1999; 1p; In English; Aerosol, 18-22 Jan. 1999, Meribel, France; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The well-calibrated spectral radiances measured by MODIS will be processed to retrieve daily aerosol properties that include optical thickness and mass loading over land and optical thickness, the mean particle size of the dominant mode and the ratio between aerosol modes over ocean. In addition, after launch, aerosol single scattering albedo will be calculated as an experimental product. The retrieval process over land is based on a dark target method that identifies appropriate targets in the mid-IR channels and uses an empirical relationship found between the mid-ER and the visible channels to estimate surface reflectance in the visible from the mid-HZ reflectance measured by satellite. The method employs new aerosol models for industrial, smoke and dust aerosol. The process for retrieving aerosol over the ocean makes use of the wide spectral band from 0.55-2.13 microns and a look-up table constructed from combinations of five accumulation modes and five coarse modes. Both the over land and over ocean algorithms have been validated with satellite and airborne radiance measurements. We estimate that MODIS will be able to measure aerosol optical thickness (t) to within 0.05 +/- 0.2t over land and to within 0.05 +/- 0.05t over ocean. Much of the earth's surface is located far from aerosol sources and experience very low aerosol optical thickness. Will the accuracy expected from MODIS retrievals be sufficient to measure the global aerosol direct and indirect forcing? We are attempting to answer this question using global model results and cloud climatology.
Author
Remote Sensing; Aerosols; Spectral Bands; Optical Thickness; Infrared Radiation; Spectral Reflectance

19990025667 NASA Goddard Space Flight Center, Greenbelt, MD USA
Global and Seasonal Aerosol Optical Depths Derived From Ultraviolet Observations by Satellites (TOMS)
Herman, J. R., NASA Goddard Space Flight Center, USA; Torres, O., NASA Goddard Space Flight Center, USA; 1999; 1p; In English; Aerosol, 18-22, Meribel, France; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

It has been shown that absorbing aerosols (dust, smoke, volcanic ash) can be detected in the ultraviolet wavelengths (331 nm to 380 nm) from satellite observations (TOMS, Total Ozone Mapping Spectrometer) over both land and water. The theoretical basis for these observations and their conversions to optical depths is discussed in terms of an aerosol index AI or N-value residue (assigned positive for absorbing aerosols). The theoretical considerations show that negative values of the AI frequently represent the presence of non-absorbing aerosols (NA) in the troposphere (mostly pollution in the form of sulfates, hydrocarbons, etc., and some natural sulfate aerosols) with particle sizes near 0.1 to 0.2 microns or less. The detection of small-particle non-absorbing aerosols from the measured backscattered radiances is based on the observed wavelength dependence from Mie scattering after the background Rayleigh scattering is subtracted. The Mie scattering from larger particles, 1 micron or more (e.g., cloud water droplets) has too small a wavelength dependence to be detected by this method. In regions that are mostly cloud free, aerosols

of all sizes can be seen in the single channel 380 nm or 360 nm radiance data. The most prominent Al feature observed is the strong asymmetry in aerosol amount between the Northern and Southern Hemispheres, with the large majority of NA occurring above 20degN latitude. The maximum values of non-absorbing aerosols are observed over the eastern U.S. and most of western Europe corresponding to the areas of highest industrial pollution. Annual cycles in the amount of NA are observed over Europe and North America with maxima occurring in the summer corresponding to times of minimum wind transport. Similarly, the maxima in the winter over the Atlantic Ocean occurs because of wind borne transport from the land. Most regions of the world have the maximum amount of non-absorbing aerosol in the December to January period except for the eastern North America and Europe. Comparisons of the estimated TOMS aerosol optical depths show good agreement in magnitude and seasonal dependence with sun-photometer optical depths obtained at Goddard Space Flight Center (39degN 76.88degW) in the U.S. and in Lille (50.63degN 3.07degE) in France. The study of these aerosols is important for detecting the sources of industrial pollution and its redistribution by winds on a global basis, as well as its effect on reducing the UV irradiance at the Earth's surface.
Author
Aerosols; Ultraviolet Radiation; Satellite Observation; Rayleigh Scattering; Optical Thickness; Troposphere; Hydrocarbons; Air Pollution; Mie Scattering

19990025776 Naval Academy, Annapolis, MD USA
A Side Scan Sonar and Sub-Bottom Profiler Study Over Buried River Channels, Chesapeake Bay
Lopes, Dewey A.; Jan. 1998; 67p; In English
Report No.(s): AD-A359089; USNA,TRIDENT-RN-257; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This study used a sub-bottom profiler and side-scan sonar to study the most recent Holocene channels in the mid-Chesapeake Bay near Annapolis, MD. Nearly two dozen transects collected approximately 150km of sub-bottom and 90km of side scan data. Analysis of the sub-bottom data suggests three strong sub-bottom returns separate four sub-bottom layers. They are found at depths between 1.5m and l4m below the sediment/water interface. Channels cut into some of these layers have a north-south orientation. Analysis of the side scan data and bathymetric profiles indicates that the orientation of the sub-bottom layering tends to follow the general bottom surface bathymetry and orientation of the present channel. Bottoms surface morphology does not appear to reflect sub-bottom characteristics. Both side scan and sub-bottom data reflect sediment deposition. Sedimentation in the study area, south of the turbidity maximum in the Chesapeake Bay, is approximately 0.05 cm/yr to 0.075 cm/yr. This estimate uses the measured layer thickness and assumes that the deepest sub-bottom retum separating the two deepest layers represents the 18,000 year old Cape Charles paleochannel. This seems plausible since the layering conforms to the depth and location of the Cape Charles paleochannel previously determined.
DTIC
Bathymeters; Chesapeake Bay (US); Cutting; Deposition; Depth; Morphology; Position (Location)

19990025953 NASA Goddard Space Flight Center, Greenbelt, MD USA
Aerosol Absorption Measurements from LANDSAT and CIMEL
Kaufman, Y. J., NASA Goddard Space Flight Center, USA; Tanre, D., Lille-1 Univ., France; Karnieli, A., Ben Gurion Univ. of the Negev, Israel; Remer, L., NASA Goddard Space Flight Center, USA; Holben, B., NASA Goddard Space Flight Center, USA; 1999; 1p; In English; Aerosoll, 18-22 Jan. 1999, Meribel, France; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Spectral remote observations of dust properties from space and from the ground create a powerful tool for determination of dust absorption of solar radiation with an unprecedented accuracy. Absorption is a key component in understanding dust impact on climate. We use LANDSAT space-borne measurements at 0.47 to 2.2 micrometer over Senegal with ground-based sunphotometers to find that Saharan dust absorption of solar radiation is two to four times smaller than in models. Though dust absorbs in the blue, almost no absorption was found for wavelengths greater than 0.6 micrometer. The new finding increases by 50% recent estimated solar radiative forcing by dust and decreases the estimated dust heating of the lower troposphere. Dust transported from Asia shows slightly higher absorption probably due to the presence of black carbon from populated regions. Large-scale application of this method to satellite data from the Earth Observing System can reduce significantly the uncertainty in the dust radiative effects.
Derived from text
Aerosols; Absorption Spectroscopy; Radiation Absorption; Solar Radiation; Earth Observing System (EOS); Dust; Satellite Observation

19990025956 NASA Goddard Space Flight Center, Greenbelt, MD USA

Estimation of Vegetation Aerodynamic Roughness of Natural Regions Using Frontal Area Density Determined from Satellite Imagery

Jasinski, Michael F., NASA Goddard Space Flight Center, USA; Crago, Richard, Illinois Univ., USA; Agricultural and Forest Meteorology; 1994; 41p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Parameterizations of the frontal area index and canopy area index of natural or randomly distributed plants are developed, and applied to the estimation of local aerodynamic roughness using satellite imagery. The formulas are expressed in terms of the subpixel fractional vegetation cover and one non-dimensional geometric parameter that characterizes the plant's shape. Geometrically similar plants and Poisson distributed plant centers are assumed. An appropriate averaging technique to extend satellite pixel-scale estimates to larger scales is provided. ne parameterization is applied to the estimation of aerodynamic roughness using satellite imagery for a 2.3 sq km coniferous portion of the Landes Forest near Lubbon, France, during the 1986 HAPEX-Mobilhy Experiment. The canopy area index is estimated first for each pixel in the scene based on previous estimates of fractional cover obtained using LANDSAT Thematic Mapper imagery. Next, the results are incorporated into Raupach's (1992, 1994) analytical formulas for momentum roughness and zero-plane displacement height. The estimates compare reasonably well to reference values determined from measurements taken during the experiment and to published literature values. The approach offers the potential for estimating regionally variable, vegetation aerodynamic roughness lengths over natural regions using satellite imagery when there exists only limited knowledge of the vegetated surface.

Author

Conifers; Vegetation; Thematic Mappers (LANDSAT); Satellite Imagery; Parameterization; Plants (Botany)

19990026152 Department of Defense, USDOE Assistant Secretary for Human Resources and Administration, Washington, DC (USA), Washington, DC USA

Using MODFLOW drains to simulate groundwater flow in a karst environment

Quinn, J., Department of Defense, USA; Tomasko, D., Department of Defense, USA; Glennon, M. A., Department of Defense, USA; Miller, S. F., Department of Defense, USA; McGinnis, L. D., Department of Defense, USA; Dec. 31, 1998; 9p; In English; MODFLOW 1998

Report No.(s): DE98-057592; ANL/EAD/CP-96746; CONF-981004; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Modeling groundwater flow in a karst environment is both numerically challenging and highly uncertain because of potentially complex flowpaths and a lack of site-specific information. This study presents the results of MODFLOW numerical modeling in which drain cells in a finite-difference model are used as analogs for preferential flowpaths or conduits in karst environments. In this study, conduits in mixed-flow systems are simulated by assigning connected pathways of drain cells from the locations of tracer releases, sinkholes, or other karst features to outlet springs along inferred flowpaths. These paths are determined by the locations of losing stream segments, ephemeral stream beds, geophysical surveys, fracture lineaments, or other surficial characteristics, combined with the results of dye traces. The elevations of the drains at the discharge ends of the inferred flowpaths are estimated from field data and are adjusted when necessary during model calibration. to simulate flow in a free-flowing conduit, a high conductance is assigned to each drain to eliminate the need for drain-specific information that would be very difficult to obtain. Calculations were performed for a site near Hohenfels, Germany. The potentiometric surface produced by the simulations agreed well with field data. The head contours in the vicinity of the karst features behaved in a manner consistent with a flow system having both diffuse and conduit components, and the sum of the volumetric flow out of the drain cells agreed closely with spring discharges and stream flows. Because of the success of this approach, it is recommended for regional studies in which little site-specific information (e.g., location, number, size, and conductivity of fractures and conduits) is available, and general flow characteristics are desired.

NTIS

Drainage; Ground Water; Flow Characteristics; Karst; Geophysics; Structural Properties (Geology)

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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.

19990025467 NASA Goddard Space Flight Center, Greenbelt, MD USA
EOS--AM1 Nickel Hydrogen Cell Interim Life Test Report
Bennett, C. W., Lockheed Martin Missiles and Space, USA; Keys, D. J., NASA Goddard Space Flight Center, USA; Rao, G. M., NASA Goddard Space Flight Center, USA; Wannemacher, H. E., Jackson and Tull, Inc., USA; Vaidyanathan H., Communications Satellite Corp., USA; Jan. 01, 1999; 27p; In English
Contract(s)/Grant(s): NAS5-32500; NAS5-32600; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper reports the interim results of the Earth Observing System AM-1 project (EOS-AM-1) nickel hydrogen cell life test being conducted under contract to National Aeronautics and Space Administration (NASA) Goddard Space Flight Center (GSFC) at the Lockheed Martin Missiles and Space (LMMS) facility in East Windsor, NJ; and at COMSAT Labs., Clarksburg, MD. The purpose of the tests is to verify that the EOS-AM-1 cell design can meet five years of real-time Low Earth Orbit (LEO) cycling. The tests include both real-time LEO and accelerated stress tests. At LMMS, the first real-time LEO simulated 99 minute orbital cycle started on February 7, 1994 and the test has been running continuously since that time, with 18202 LEO cycles completed as of September 1, 1997. Each cycle consists of a 64 minute charge (VT at 1.507 volts per cell. 1.06 C/D ratio, followed by 0.6 ampere trickle charge) and a 35 minute constant power discharge at 177 watts (22.5% DOD). At COMSAT, the accelerated stress test consists of 90 minute orbital cycles at 60% DOD with a 30 minute discharge at 60 amperes and a 60 minute charge at 40 amperes (VT at 1.54 volts per cell to 1.09 C/D ratio, followed by 0.6 ampere trickle charge). The real-time LEO life test battery consists of seven, 50AH (nameplate rating) Eagle-Picher, Inc. (EPI) Mantech cells manufactured into three. 3-cell pack assemblies (there are two place holder cells that are not part of the life test electrical circuit). The test pack is configured to simulate the conductive thermal design of the spacecraft battery, including: conductive aluminum sleeves, 3-cell pack aluminum baseplate, and honeycomb panel all mounted to a liquid (-5 C) cold plate. The entire assembly is located in a thermal chamber operatina at +30 C. The accelerated stress test unit consists of five cells mounted in machined aluminum test sleeves and is operating at +10 C. The real-time LEO life test battery has met all performance requirements throuch the first 18,202 cycles, including: end of chargee and discharge cell voltages and voltace -radients; end of charge and discharge cell pressures; within cell and between cell temperature gradients; discharge capacity; current and power levels; and all charge parameters. The accelerated stress test battery has completed 11,998 cycles when the test was terminated. The stress test unit met all test parameters. This paper reports battery performances as a function of cycle life for both the real time LEO and the accelerated life test regimes.
Author
Accelerated Life Tests; Electrolytic Cells; Life (Durability); Load Tests; Low Earth Orbits; Nickel Hydrogen Batteries; Real Time Operation; Performance Tests

19990025569 Institute of Environmental Sciences, Energy Research and Process Innovation TNO, Apeldoorn, Netherlands
Testing of a 1kW De Nora Solid Polymer Electrolyte Fuel Cell in Combination With a Lead Acid Battery *Final Report Het Testen van een 1 kW De Nora Vaste Polymeer Elektrolyt Brandstofcel in Combinatie Met een Loodzwavelzuuraccu; Eindrapport*
Kluiters, E. E.; terVeen, W. R.; Schmal, D.; Sep. 1998; 22p; In Dutch
Report No.(s): AD-A359279; R98/269; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The development of fuel cells for traction accelerated the last years because of severe emission demands for road vehicles. Because of these rapid developments a commercial application in 5 to 10 years is feasible which means that the fuel cell can be used for the generation of electric energy on board of naval ships currently being developed. In the application of fuel cells and the integration in a ship's system, the combination with a battery is important. To get insight in the possible problems involved, TNO has carried out orientating tests with a fuel cell/battery combination. The underlying report describes the results. The tests carried out are related to charging of the battery with the fuel cell (at various initial states of charge of the battery) and taking a continuously increasing power out of the fuel cell/battery combination. No tests with a DC/DC converter have been carried out so far, because battery and fuel cell voltage were adapted to each other and because of the orientating character of the study. The tests show that this is possible without any problems. However, in practice, DC/DC converters will generally be required for various reasons. Therefore further development and testing of this combination, including DC/DC converters, control equipment etc. is advised.
DTIC
Electric Batteries; Electrolytic Cells; Solid Electrolytes; Voltage Converters (DC to DC)

19990025949 Army Research Lab., Sensors Directorate, Adelphi, MD USA
Critical Grain Size for Microcracking During Lithium Insertion ***Final Report, 15 Oct. - 5 Nov. 1998***
Wolfenstine, Jeff; Dec. 1998; 13p; In English
Report No.(s): AD-A358860; ARL-TN-129; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

I derived a critical grain size below which microcracking does not occur based on volume changes as a result of Li charging into brittle Li-alloys. The predicted critical grain size is less than the unit cell size for a majority of single-phase materials. This suggests that decreasing the particle and/or grain size is not a practical solution for solving the mechanical instability problem of Li-alloys.
DTIC
Brittleness; Grain Size

19990025999 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Model library of solar thermal electric components for the computer code TRNSYS
Pitz-Paal, R., Department of Energy, USA; Jones, S., Department of Energy, USA; Dec. 31, 1998; 7p; In English; 9th; Solar thermal concentrating technologies
Report No.(s): DE98-003543; SAND-98-1494C; CONF-980663; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A new approach to modeling solar thermal electric plants using the TRNSYS simulation environment is discussed. The TRNSYS environment offers many advantages over currently used tools, including the option to more easily study the hybrid solar/fossil plant configurations that have been proposed to facilitate market penetration of solar thermal technologies. A component library developed for Rankine cycle, Brayton cycle, and solar system modeling is presented. A comparison between KPRO and TRNSYS results for a simple Rankine cycle show excellent correlation.
NTIS
Solar System; Subroutine Libraries (Computers)

19990026001 Department of Energy, Office of Energy Research, Washington, DC USA
Evaluation of Demo 1C composite flywheel rotor burst test and containment design
Kass, M. D., Department of Energy, USA; McKeever, J. W., Department of Energy, USA; Akerman, M. A., Department of Energy, USA; Goranson, P. L., Department of Energy, USA; Litherland, P. S., Department of Energy, USA; Dec. 31, 1998; 37p; In English
Report No.(s): DE98-003625; ORNL/TM-13159; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Laboratory-Directed funds were provided in FY 1995 for research to develop flywheel containment specifications and to consider concepts that could satisfy these specifications and produce a prototype small, lightweight, inexpensive, mobile flywheel containment. Research activities have included an analytical and pictorial review of the Demo 1C flywheel failure test, which provided significant insight about radial and axial failure modes; calculations of the thickness of ultra-conservative pressure vessel containment; entertainment of advanced containment concepts using lightweight materials and armor literature; consideration of fabrication assembly procedures; and participation in a Flywheel Energy Storage Workshop during which additional flywheel failure experiences were discussed. Based on these activities, calculations, and results, a list of conclusions concerning flywheel containment and its relation to the flywheel are presented followed by recommendations for further research.
NTIS
Flywheels; Burst Tests; Containment

19990026005 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Solar energy conversion at dye sensitized nanostructured electrodes fabricated by sol-gel processing ***Final Report***
Searson, P. C., Department of Energy, USA; Meyer, G. J., Department of Energy, USA; Jul. 31, 1998; 27p; In English
Report No.(s): DE98-003771; NREL/SR-520-24521; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The significant achievements accomplished in this program include: (1) the first demonstration of osmium polypyridyl compounds as sensitizers; (2) the first demonstration of donor-acceptor compounds as sensitizers; (3) the first utilization of alternative acac based sensitizer-semiconductor linkages; (4) the first demonstration of remote interfacial electron transfer; (5) the first application of bimetallic compounds as sensitizers; (6) the first correlation of the interfacial charge recombination rate constant with the open circuit photovoltage in sensitized materials; (7) the first demonstration of a solid state dye sensitized TiO(sub 2) cell; (8) an alternative band edge unpinning model for the nanocrystalline TiO(sub 2)/electrolyte interface at negative applied

potentials; and (9) the first self-consistent model of electron transport in dye sensitized TiO(sub 2) films. In the following sections the authors summarize some of the results from this program and highlight the key findings.
NTIS
Solar Energy Conversion; Dyes; Electrodes; Fabrication; Sol-Gel Processes; Sensitizing

19990026203 Prins Maurits Lab. TNO, Rijswijk, Netherlands
Energy Storage in Superconducting Coils: Basic Principles ***Final Report Energieopslag in Supergeleidende Basisprincipes***
Jongeleen, S. M., Prins Maurits Lab. TNO, Netherlands; October 1998; In Dutch; Original contains color illustrations
Contract(s)/Grant(s): B94/KM/414
Report No.(s): TD98-0312; TNO-PML-1998-A71; Copyright; Avail: Issuing Activity (TNO Prins Maurits Lab., P.O. Box 45, 2280 AA Rijswijk, The Netherlands), Hardcopy, Microfiche

To study the possibilities and options for energy storage in Superconducting Magnetic Energy Storage (SMES) systems, a simple computer code has been developed to estimate the limitations of such a system for the generation of high power pulses. The loss models implemented in the computer code and the results of a few simulations with solenoids are presented which demonstrate the influence of the wire parameters and the coil design on the energy content and maximum power output of a coil.
Author
Energy Storage; Superconductivity; Research; Computer Programs; Magnetic Coils

19990026379 Department of Energy, Washington, DC USA
Thin-film solid-oxide fuel cells
Jankowski, A. F., Department of Energy, USA; May 01, 1997; 10p; In English; 48th; 192nd; Electrochemical Society, USA, USA
Report No.(s): DE98-050882; UCRL-JC-126877; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Fuel cells are energy conversion devices that would save billions of dollars in fuel costs alone each year in the USA if they could be implemented today for stationary and transportation applications (1-5). There are a wide variety of fuel cells available, e.g. molten carbonate, phosphoric acid, proton exchange membrane and solid-oxide. However, solid-oxide fuel cells (SOFCS) are potentially more efficient and less expensive per kilowatt of power in comparison to other fuel cells. For transportation applications, the energy efficiency of a conventional internal combustion engine would be increased two- fold as replaced with a zero-emission SOFC. The basic unit of a SOFC consists of an anode and cathode separated by an oxygen-ion conducting, electrolyte layer. Manifolded stacks of fuel cells, with electrical interconnects, enable the transport and combination of a fuel and oxidant at elevated temperature to generate electrical current. Fuel cell development has proceeded along different paths based on the configuration of the anode-electrolyte-cathode. Various configurations include the tubular, monolithic and planar geometries. A planar geometry for the anode-electrolyte-cathode accompanied by a reduction in layer thickness offers the potential for high power density. Maximum power densities will require yet additional innovations in the assembly of fuel cell stacks with all of the manifolding stipulations for gas flow and electrical interconnects.
NTIS
Fuel Cells; Conferences; Thin Films; Solid Oxide Fuel Cells; Energy Conversion; Internal Combustion Engines

19990026438 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Energy Efficient Motor Application
Koenig, Stephen R.; Jan. 20, 1999; 110p; In English
Report No.(s): AD-A359988; AFIT-FY99-56; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Motor driven processes represent a large portion of the energy consumption in the USA and, as a result, present a large opportunity for energy savings. Energy efficient motors reduce energy use and will see wider implementation as the impact of the Energy Policy Act of 1992 is felt. These motors are made possible by design and material improvements without compromising reliability, quality, or performance. One drawback is their potential for nuisance tripping due to a high inrush current at starting. Solutions do exist to this problem. Economics also play a large role in energy efficient motor application. The cost of repairing a motor or installing a new machine as well as any utility rebates determine if the efficient motor price premium is offset by energy savings. Other issues are adjustable speed drives, belts and supply voltage affect efficiency as well. Several industry examples demonstrate the potential results. A thorough understanding of these factors show the energy efficient motor can be a good choice for most applications.
DTIC
Energy Conservation; Mechanical Drives; Electric Motors; Energy Consumption; Electrical Properties

19990026502 Department of the Navy, Washington, DC USA
NICAD Deep Cycle Charging/Discharging System
Kern, Lynn R., Inventor; Jul. 07, 1998; 8p; In English
Patent Info.: Filed 30 Sep. 96,; US-Patent-Appl-SN-730,138; US-Patent-5,777,456
Report No.(s): AD-D019244; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A charging/discharging apparatus uses constant charging current and constant discharging current to reduce the possibility of building memory in the cells of a battery. Memory reduces battery capacity and eventual failure will result since the cells will refuse to take any charge. A charger circuit includes a current source receiving supply voltage to couple constant charging current to the battery and an amplifier is coupled to receive reference voltage from a source and feedback voltage from the battery to connect supply voltage to the current source when the reference voltage is greater than the feedback voltage. A discharger circuit utilizes a current sink receiving supply voltage to couple constant discharging current to the battery. An amplifier receives reference voltage from a source and feedback voltage from the battery to connect supply voltage to the current sink when the reference voltage is less than the feedback voltage. In both charger and discharger applications the current source or current sink maintains a constant current to the battery independently of the magnitude of voltage of the battery. This use of constant current does not rely on battery voltage to charge the cell and can discharge a cell well below the minimum operating voltage. The apparatus is particularly adaptable to recharge NiCad batteries which require specific conditions to properly charge and deep-cycle discharge for maximum life.
DTIC
Battery Chargers; Nickel Cadmium Batteries; Electric Potential; Life (Durability)

19990026589 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Modular simulation of a hybrid power system with diesel and wind turbine generation
Bialasiewicz, J. T., Department of Energy, USA; Mulijadi, E., Department of Energy, USA; Drouilhet, S., Department of Energy, USA; Nix, G., Department of Energy, USA; Jun. 30, 1998; 11p; In English; Windpower '98, USA
Report No.(s): DE98-005793; NREL/CP-500-24681; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In this paper, the authors present the modular simulation tool they developed to help study the system dynamics for wind-diesel power systems. The principal modules of the simulator, which include a diesel generator, a wind turbine generator, a rotary converter with a battery, a village load and a dump load, are described. With a case study, the authors demonstrate how the designer benefits from easily understanding the effects of system modifications. Using this tool, a designer can easily develop control strategies to balance the system power flows under different generation/load conditions.
NTIS
Wind Turbines; Diesel Engines; Simulators; Windpower Utilization

19990026599 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Trimode optimizes hybrid power plants, Phase 2 ***Final Report***
O'Sullivan, G. A., Department of Energy, USA; O'Sullivan, J. A., Department of Energy, USA; Jul. 31, 1998; 57p; In English
Report No.(s): DE98-006278; SAND-98-0499; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In the Phase 2 project, Abacus Controls Inc. did research and development of hybrid systems that combine the energy sources from photovoltaics, batteries, and diesel-generators and demonstrated that they are economically feasible for small power plants in many parts of the world. The Trimode Power Processor reduces the fuel consumption of the diesel-generator to its minimum by presenting itself as the perfect electrical load to the generator. A 30 kW three-phase unit was tested at Sandia National Laboratories to prove its worthiness in actual field conditions. The use of photovoltaics at remote locations where reliability of supply requires a diesel-generator will lower costs to operate by reducing the run time of the diesel generator. The numerous benefits include longer times between maintenance for the diesel engine and better power quality from the generator.
NTIS
Power Supplies; Photovoltaic Conversion

19990026671 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Photovoltaic manufacturing technology monolithic amorphous silicon modules on continuous polymer substrates ***Annual Report, 5 Jul. 1996 - 31 Dec. 1997***
Jeffrey, F., Department of Energy, USA; Aug. 31, 1998; 27p; In English
Report No.(s): DE98-006188; NREL/SR-520-25236; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Iowa Thin Film Technologies, Inc.'s (ITF) goal is to develop the most cost effective PV manufacturing process possible. to this end the authors have chosen a roll based manufacturing process with continuous deposition and monolithic integration. Work under this program is designed to meet this goal by improving manufacturing throughput and performance of the manufactured devices. Significant progress was made during Phase 2 of this program on a number of fronts. A new single pass tandem deposition machine was brought on line which allows greatly increased and improved throughput for rolls of tandem material. The TCO deposition process was improved resulting in an increase in throughput by 20%. A new alignment method was implemented on the printing process which improves throughput six fold while improving alignment from 100 (micro)m to 10 (micro)m. A roll based lamination procedure was developed and implemented on selected products which improves throughput from 20 sq. ft./hr. to 240 sq. ft./hr. A wide range of lower cost encapsulants were evaluated. A promising material was selected initially to be introduced in 5 year lifetime type products. The sum of these improvements bring the overall cost reduction resulting from this program to 49%.
NTIS
Amorphous Silicon; Modules; Substrates; Manufacturing; Technology Assessment

19990026672 Department of Energy, Washington, DC USA
Revolutions in energy through modeling and simulation
Tatro, M., Department of Energy, USA; Woodard, J., Department of Energy, USA; Dec. 31, 1998; 9p; In English; 19th; Meeting sponsored in part by International Association for Energy Economics
Report No.(s): DE98-006181; SAND-98-1895C; CONF-981026; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The development and application of energy technologies for all aspects from generation to storage have improved dramatically with the advent of advanced computational tools, particularly modeling and simulation. Modeling and simulation are not new to energy technology development, and have been used extensively ever since the first commercial computers were available. However, recent advances in computing power and access have broadened the extent and use, and, through increased fidelity (i.e., accuracy) of the models due to greatly enhanced computing power, the increased reliance on modeling and simulation has shifted the balance point between modeling and experimentation. The complex nature of energy technologies has motivated researchers to use these tools to understand better performance, reliability and cost issues related to energy. The tools originated in sciences such as the strength of materials (nuclear reactor containment vessels); physics, heat transfer and fluid flow (oil production); chemistry, physics, and electronics (photovoltaics); and geosciences and fluid flow (oil exploration and reservoir storage). Other tools include mathematics, such as statistics, for assessing project risks. This paper describes a few advancements made possible by these tools and explores the benefits and costs of their use, particularly as they relate to the acceleration of energy technology development. The computational complexity ranges from basic spreadsheets to complex numerical simulations using hardware ranging from personal computers (PCs) to Cray computers. In all cases, the benefits of using modeling and simulation relate to lower risks, accelerated technology development, or lower cost projects.
NTIS
Energy Technology; Management Methods; Technology Utilization; Computerized Simulation; Energy Sources

19990026674 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Development of a low-cost integrated 20-kW-AC solar tracking subarray for grid-connected PV power system applications *Final Report*
Stern, M., Department of Energy, USA; Duran, G., Department of Energy, USA; Fourer, G., Department of Energy, USA; Mackamul, K., Department of Energy, USA; Whalen, W., Department of Energy, USA; Jun. 30, 1998; 39p; In English
Report No.(s): DE98-005947; NREL/SR-520-24759; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This report chronicles Utility Power Group's (UPG) successful two-year Photovoltaic Manufacturing Technology (PVMaT) Phase 4A1 work effort which began in July, 1995. During this period, UPG completed design, fabrication, testing and demonstration of a modular and fully integrated 15-kW-ac, solar tracking PV power system sub-array. The two key and innovative components which were developed are a Modular Panel which optimizes factory assembly of PV modules into a large area, field-deployable, structurally-integrated PV panel, and an Integrated Power Processing Unit which combines all dc and ac power collection, conversion and control functions within a single, field-deployable structurally- integrated electrical enclosure. These two key sub-array elements, when combined with a number of other electrical, mechanical, and structural components, create a

low-cost and high-performance PV power system. This system, or sub-array, can be deployed in individual units, or paralleled with any number of other sub-arrays, to construct multi-megawatt P fields.
NTIS
Low Cost; Manufacturing; Electric Power Supplies; Structural Design; Photovoltaic Effect; Electric Power Plants; Solar Cells; Tracking (Position)

45
ENVIRONMENT POLLUTION

Includes atmospheric, noise, thermal, and water pollution.

19990025208 Battelle Memorial Inst., Columbus, OH USA
Enhanced Biodegradation Through Soil Venting ***Final Report, 23 Jun. 1989 - 22 Aug. 1990***
Hinchee, Robert E.; Nov. 1998; 287p; In English
Contract(s)/Grant(s): F08635-85-C-0122
Report No.(s): AD-A359334; AFRL-ML-TY-TR-1998-4546; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche
The objective of this report was to investigate the potential for enhanced biodegradation of JP-4 jet fuel in the vadose zone by providing O2 through soil venting with added moisture and nutrients. Two treatment and two background plots were used, with different combinations of venting, moisture and nutrient additions at each one. Biodegradation rates varied from 2 to 20 mg/kg/day, with an average of 5 mg/(kg day). Moisture and nutrient addition had no apparent effect on biodegradation rates. The effects of soil temperature on biodegradation rates were shown to approximate effects predicted by the Van't Hoff-Arrhenius equation. In one treatment cell, approximately 26 kg of hydrocarbons/contaminants were volatilized and 32 kg were biodegraded. Although this equates to 55 percent of the total removal attributed to biodegradation, a series of flow rate tests showed that removal due to biodegradation could be increased to 85 percent by simply managing the air flow rates. Proper design and air flow management could result in complete biological mineralization of jet fuel, thereby reducing remediation costs.
DTIC
Biodegradation; Flow Distribution; Temperature Effects; Reaction Kinetics; Soils; Air Flow

19990025446 NASA Goddard Inst. for Space Studies, New York, NY USA
Late-Glacial to Early Holocene Climate Changes from a Central Appalachians Pollen and Macrofossil Record
Kneller, Margaret, NASA Goddard Inst. for Space Studies, USA; Peteet, Dorothy, NASA Goddard Inst. for Space Studies, USA; Quaternary Research; 1997; 44p; In English
Contract(s)/Grant(s): NSF ATM-94-17160
Report No.(s): LDEO-Contrib-5849; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
A Late-glacial to early Holocene record of pollen, plant macrofossils and charcoal, based on two cores, is presented for Browns Pond in the central Appalachians of Virginia. An AMS radiocarbon chronology defines the timing of moist and cold excursions, superimposed upon the overall warming trend from 14,200 to 7,500 C-14 yr B.P. This site shows cold, moist conditions from approximately 14,200 to 12,700 C-14 yr B.P., with warming at 12,730, 11,280 and 10,050 C-14 yr B.P. A decrease in deciduous broad-leaved tree taxa and Pinus strobus (haploxylon) pollen, simultaneous with a re-expansion of Abies denotes a brief, cold reversal from 12,260 to 12,200 C-14 yr B.P. A second cold reversal, inferred from increases in montane conifers, is centered at 7,500 C-14 yr B.P. The cold reversals at Browns Pond may be synchronous with climate change in Greenland, and northwestern Europe. Warming at 11,280 C-14 yr B.P. shows the complexity of regional climate responses during the Younger Dryas chronozone.
Author
Climate Change; Pollen; Fossils; Climate; Plants (Botany); Geology; Chronology; Climatology

19990025450 NASA Goddard Inst. for Space Studies, New York, NY USA
Climate Forcings in the Industrial Era
Hansen, James E., NASA Goddard Inst. for Space Studies, USA; Sato, Makiko, NASA Goddard Inst. for Space Studies, USA; Lacis, Andrew, NASA Goddard Inst. for Space Studies, USA; Ruedy, Reto, NASA Goddard Inst. for Space Studies, USA; Tegen, Ina, NASA Goddard Inst. for Space Studies, USA; Matthews, Elaine, NASA Goddard Inst. for Space Studies, USA; Proceedings of the National Academy of Sciences; October 1998; Volume 95, pp. 12753-12758; In English, 4 Feb. 1999, USA; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The forcings that drive long-term climate change are not known with an accuracy sufficient to define future climate change. Anthropogenic greenhouse gases (GHGs), which are well measured, cause a strong positive (warming) forcing. But other, poorly measured, anthropogenic forcings, especially changes of atmospheric aerosols, clouds, and land-use patterns, cause a negative forcing that tends to offset greenhouse warming. One consequence of this partial balance is-that the natural forcing due to solar irradiance changes may play a larger role in long-term climate change than inferred from comparison with GHGs alone. Current trends in GHG climate forcings are smaller than in popular ”business as usual” or 1% per year CO2 growth scenarios. The summary implication is a paradigm change for long-term climate projections: uncertainties in climate forcings have supplanted global climate sensitivity as the predominant issue.
Author
Aerosols; Atmospheric Heating; Climate Change; Climatology; Greenhouse Effect; Ozone Depletion; Clouds (Meteorology)

19990025471 NASA Goddard Space Flight Center, Greenbelt, MD USA
Long-Term Arctic Peatland Dynamics, Vegetation and Climate History of the Pur-Taz Region, Western Siberia
Peteet, Dorothy, NASA Goddard Space Flight Center, USA; Andreev, Andrei, NASA Goddard Space Flight Center, USA; Bardeen, William, Lamont-Doherty Geological Observatory, USA; Mistretta, Francesca, Lamont-Doherty Geological Observatory, USA; 1998; 40p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Stratigraphic analyses of peat composition, LOI, pollen, spores, macrofossils, charcoal, and AMS ages are used to reconstruct the peatland, vegetation and climatic dynamics in the Pur-Taz region of western Siberia over 5000 years (9300 - 4500 BP). Section stratigraphy shows many changes from shallow lake sediment to different combinations of forested or open sedge, moss, and Equisetum fen and peatland environments. Macrofossil and pollen data indicate that Larix sibirica and Betula pubescens trees were first to arrive, followed by Picea obovata. The dominance of Picea macrofossils 6000-5000 BP in the Pur-Taz peatland along with regional Picea pollen maxima indicate warmer conditions and movement of the spruce treeline northward at this time. The decline of pollen and macrofossils from all of these tree species in uppermost peats suggests a change in the environment less favorable for their growth, perhaps cooler temperatures and/or less moisture. of major significance is the evidence for old ages of the uppermost peats in this area of Siberia, suggesting a real lack of peat accumulation in recent millennia or recent oxidation of uppermost peat.
Author
Arctic Regions; Conifers; Forests; Peat; Pollen; Siberia; Vegetation; Paleoclimatology; Carbon

19990025656 Earth Technology, Inc., Alexandria, VA USA
IRP, Aerobic Cometabolic In Situ Bioremediation Technology Guidance Manual and Screening Software User’s Guide
Jun. 1998; 84p; In English
Contract(s)/Grant(s): F41624-94-D-8044
Report No.(s): AD-A359333; AFRL-ML-TY-TR-1998-4530; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Trichioroethene (TCE) is the most commonly detected contaminant at Super fund sites in the U.S.. It has been widely used for degreasing and cleaning activities. TCE was commonly discharged to the environment for disposal purposes. In recent years, the hazards of exposure to TCE and other chlorinated aliphatic hydrocarbons (CAHs) have been documented. These compounds can pose a serious threat to human health or the environment. Aerobic cometabolic in situ bioremediation is an innovative technology being used for treatment of groundwater contaminated with CAHs, especially TCE. This document presents the principles of aerobic cometabolic in situ bioremediation as well as mathematical models used describe the technology and a discussion of its applicability and limitations. A section of this document describes a software program that can help determine if this technology is appropriate for implementation. The steps needed to design and implement the technology, based upon results of a full-scale evaluation at Edwards AFB, CA, are also presented. The document concludes with a discussion surrounding regulatory acceptance the technology and a description of case studies where the technology has been implemented in the field. This document is designed for use by project managers not necessarily experienced in treatment technology design who are exploring potential technology alternatives for groundwater treatment.
DTIC
Aliphatic Hydrocarbons; Hydrocarbons; Contamination; Computer Programs; Chlorocarbons

19990025889 Missouri Univ., Cloud and Aerosol Sciences Lab., Rolla, MO USA
Particulate Characterization of Commercial Jet Engine Emissions at Cruise *Final Report*
Hagen, Donald E., Missouri Univ., USA; Whitefield, Philip D., Missouri Univ., USA; 1998; 1p; In English
Contract(s)/Grant(s): NAG1-1632; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This NASA Langley grant NLPN 94-5 supported UMR/CASI's participation: (1) in the European Commissions research program POLINAT during its summer campaign in 1995, and (2) in the NASA flight campaign SUCCESS in the spring and early summer of 1996. The successful completion of these grants is evidenced by the publications that have resulted from this work. Author

Jet Engines; Exhaust Emission

19990025891 Colorado Univ., Dept. of Chemistry and Biochemistry, Boulder, CO USA

Heterogeneous Chemistry Related to Stratospheric Aircraft ***Final Report, 1 Mar. 1992 - 31 Aug. 1995***

Tolbert, Margaret A., Colorado Univ., USA; 1995; 5p; In English

Contract(s)/Grant(s): NAG2-760; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Emissions from stratospheric aircraft that may directly or indirectly affect ozone include NO(y), H2O, soot and sulfuric acid. to fully assess the impact of such emissions, it is necessary to have a full understanding of both the homogeneous and heterogeneous transformations that may occur in the stratosphere. Heterogeneous reactions on stratospheric particles play a key role in partitioning ozone-destroying species between their active and reservoir forms. In particular, heterogeneous reactions tend to activate odd chlorine while deactivating odd nitrogen. Accurate modeling of the net atmospheric effects of stratospheric aircraft requires a thorough understanding of the competing effects of this activation/deactivation. In addition, a full understanding of the potential aircraft impacts requires that the abundance, composition and formation mechanisms of the particles themselves be established. Over the last three years with support from the High Speed Research Program, we have performed laboratory experiments to determine the chemical composition, formation mechanism, and reactivity of stratospheric aerosols.
Author

Heterogeneity; Chemical Composition; Emission Spectra; Atmospheric Effects; Ozone

19990025982 Georgia Tech Research Inst., Atlanta, GA USA

Towards a Theory of Tropical/Midlatitude Mass Exchange from the Earth's Surface through the Stratosphere ***Final Report, 1 Dec. 1995 - 30 Nov. 1998***

Hartley, Dana, Georgia Tech Research Inst., USA; 1998; 40p; In English

Contract(s)/Grant(s): NAG5-2789; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The main findings of this research project have been the following: (1) there is a significant feedback from the stratosphere on tropospheric dynamics, and (2) a detailed analysis of the interaction between tropical and polar wave breaking in controlling stratospheric mixing. Two papers are were written and are included. The first paper is titled, "A New Perspective on the Dynamical Link Between the Stratosphere and Troposphere." Atmospheric processes of tropospheric origin can perturb the stratosphere, but direct feedback in the opposite direction is usually assumed to be negligible, despite the troposphere's sensitivity to changes in the release of wave activity into the stratosphere. Here, however, we present evidence that such a feedback exists and can be significant. We find that if the wintertime Arctic polar stratospheric vortex is distorted, either by waves propagating upward from the troposphere or by eastward-travelling stratospheric waves, then there is a concomitant redistribution of stratospheric potential vorticity that induces perturbations in key meteorological fields in the upper troposphere. The feedback is large despite the much greater mass of the troposphere: it can account for up to half of the geopotential height anomaly at the tropopause. Although the relative strength of the feedback is partly due to a cancellation between contributions to these anomalies from lower altitudes, our results imply that stratospheric dynamics and its feedback on the troposphere are more significant for climate modelling and data assimilation than was previously assumed. The second article is titled "Diagnosing the Polar Excitation of Subtropical Waves in the Stratosphere". The poleward migration of planetary scale tongues of subtropical air has often been associated with intense polar vortex disturbances in the stratosphere. This question of vortex influence is reexamined from a potential vorticity (PV) perspective. Anomalous geopotential height and wind fields associated solely with vortex PV anomalies are derived and their impact on the stratospheric subtropical circulation is evaluated. Combined PV inversion and Contour Advection (CA) calculations indicate that transient large scale disturbances of the polar vortex do have a far reaching impact that extends beyond the midlatitude surf zone all the way to the subtropics. This vortex influence is clearly non-local so that even simple wave 2 distortions that leave the vortex well confined within the midlatitudes are observed to excite subtropical waves. Treating subtropical PV as active tracers also showed that upon entrainment, these large scale tongues of low PV air also influenced the dynamics of their own poleward migration.
Author (revised)

Atmospheric Circulation; Geopotential Height; Meteorological Parameters; Stratosphere; Troposphere; Vortices; Vorticity; Temperate Regions; Polar Regions; Potential Flow; Advection

19990026097 Joint Publications Research Service, Arlington, VA USA
JPRS Report, Environmental Issues
Jul. 09, 1992; 96p; In English
Report No.(s): AD-A358783; JPRS-TEN-92-014; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report contains translations/transcriptions of articles and/or broadcasts on environmental issues around the world. This document concerns Environmental Issues; topics include international affairs, climate, nuclear testing, environmental issues, policies, toxic wastes, air pollution, waste processing, forest preservation and environmental protection.
CASI
Research and Development; Environment Protection; Environment Management

19990026098 Joint Publications Research Service, Arlington, VA USA
JPRS Report, Environmental Issues
Jul. 07, 1992; 78p; In English
Report No.(s): AD-A358785; JPRS-TEN-92-013; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report contains translations/transcriptions of articles and/or broadcasts on environmental issues around the world. This document concerns Environmental Issues; topics include international affairs, climate, nuclear testing, environmental issues, policies, toxic wastes, air pollution, waste processing, forest preservation and environmental protection.
CASI
Research and Development; Environment Protection; Environment Management; Environment Effects; Environmental Monitoring

19990026117 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Evaluation of the Methane Emission in Tucurui Reservoir using Multitemporal TM Images to Define Fieldwork Sampling Stations *Utilizacao de Imagens Historicas tm Para Avaliacao e Monitoramento da Emissao de CH4 NA UHE Tucurui*
TavaresdeLima, Ivan Bergier, Instituto Nacional de Pesquisas Espacias, Brazil; 1998; 116p; In Portuguese
Report No.(s): INPE-6821-TDI/642; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Remote sensing techniques were applied to identify sample stations to assess the respiratory processes cf the Tucurui reservoir and to estimate methane (CH4) fluxes between water and atmosphere interface. The results suggest that tributaries often covered by floating macrophytes are significant CH4 sources to the atmosphere. A CH4 concentration gradient indicates horizontal fluxes from tributaries to the main channel. As a result, open water areas may emit large amount of the CH4 produced in tributaries.
Author
Evaluation; Methane; Emission; Water; Tributaries

19990026216 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA
Tritium monitor calibration at Los Alamos National Laboratory
Bjork, C. J., Department of Energy, USA; Aikin, D. J., Department of Energy, USA; Houlton, T. W., Department of Energy, USA; Aug. 31, 1997; 16p; In English; 42nd; Health Physics Society
Report No.(s): DE97-008891; LA-UR-97-2406; CONF-9706122; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Tritium in air is monitored at Los Alamos National Laboratory (LANL) with air breathing instruments based on ionization chambers. Stack emissions are continuously monitored from sample tubes which each connect to a Tritium bubble which differentially collects HTO and HT. A set of glass vials of glycol capture the HTO. The HT is oxidized with a palladium catalyst and the resultant HTO is captured in a second set of vials of glycol. The glycol is counted with a liquid scintillation counter. All calibrations are performed with tritium containing gas. The Radiation Instrumentation and Calibration (RIC) Team has constructed and maintains two closed loop gas handling systems based on femto TECH model U24 tritium ion chamber monitors: a fixed system housed in a fume hood and a portable system mounted on two two wheeled hand trucks. The U24 monitors are calibrated against tritium in nitrogen gas standards. They are used as standard transfer instruments to calibrate other ion chamber monitors with tritium in nitrogen, diluted with air. The gas handling systems include a circulation pump which permits a closed circulation loop to be established among the U24 monitor and typically two to four other monitors of a given model during calibration. Fixed and portable monitors can be calibrated. The stack bubblers are calibrated in the field by: blending a known concentration of tritium in air within the known volume of the two portable carts, coupled into a common loop; releasing that gas mixture into a ventilation intake to

the stack; collecting oxidized tritium in the bubbler; counting the glycol; and using the stack and bubbler flow rates, computing the bubbler's efficiency. Gas calibration has become a convenient and quality tool in maintaining the tritium monitors at LANL.
NTIS
Tritium; Monitors; Calibrating

19990026223 Department of Energy, Office of Energy Research, Washington, DC USA
Assessing the climatic effect of carbon dioxide and other trace gases using an interactive two-dimensional climate-chemistry model ***Final Report, Dec. 1992 - Aug. 1996***
Ko, M. K. W., Department of Energy, USA; Dec. 31, 1996; 32p; In English
Report No.(s): DE98-006282; DOE/ER/60485-T3; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In the recent IPCC report, the role of tropospheric aerosols, stratospheric aerosols, and natural solar variability have also been identified as having sizable effects on climate, both by direct perturbation of the radiative balance and indirectly by changing ozone. Although the effect of changing CO(sub 2) is by far the dominant factor on a century time scale, the effects from the other identified factors are important on a decade time scale. It is important to understand the mechanisms that relate these changes to climatic responses. Developing appropriate numerical models with the capability to simulate these mechanisms will enable one to correctly interpret the observed climate changes that have occurred to data, as well as predict future changes in climate. It is presently impractical to run comprehensive 3-D general circulation model simulations of the interactions between atmospheric chemistry and the rest of the climate system on time scales of decades to centuries. Thus, 2-D models and other lower resolution models play an essential role in understanding the complex interactions of the integrated climate system.
NTIS
Carbon Dioxide; Climate Change; Atmospheric Chemistry; Climate Models; Climatology; Mathematical Models; Ozone

19990026278 Department of Energy, Office of Energy Research, Washington, DC USA
COMIS: An international multizone air-flow and contaminant transport model
Feustel, H. E., Department of Energy, USA; Aug. 31, 1998; 31p; In English
Report No.(s): DE98-059388; LBNL-42182; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A number of interzonal models have been developed to calculate air flows and pollutant transport mechanisms in both single and multizone buildings. A recent development in multizone air-flow modeling, the COMIS model, has a number of capabilities that go beyond previous models, much as COMIS can be used as either a stand-alone air-flow model with input and output features or as an infiltration module for thermal building simulation programs. COMIS was designed during a 12 month workshop at Lawrence Berkeley National Laboratory (LBNL) in 1988-89. In 1990, the Executive Committee of the International Energy Agency's Energy Conservation in Buildings and Community Systems program created a working group on multizone air-flow modeling, which continued work on COMIS. The group's objectives were to study physical phenomena causing air flow and pollutant (e.g., moisture) transport in multizone buildings, develop numerical modules to be integrated in the previously designed multizone air flow modeling system, and evaluate the computer code. The working group supported by nine nations, officially finished in late 1997 with the release of IISiBat/COMIS 3.0, which contains the documented simulation program COMIS, the user interface IISiBat, and reports describing the evaluation exercise.
NTIS
Air Flow; Buildings; Indoor Air Pollution; Computer Programs; Computerized Simulation; Contaminants

19990026374 Department of Energy, Washington, DC USA
High Exposure Rate Hardware ALARA Plan
Nellesen, A. L., Department of Energy, USA; Sep. 30, 1997; 8p; In English
Report No.(s): DE98-051291; BHI-00825-REV1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This As Low As Reasonably Achievable review provides a description of the engineering and administrative controls used to manage personnel collective dose and to control contamination levels and airborne radioactivity concentrations while conducting work related to high exposure rate hardware removal.
NTIS
Radioactivity; Contamination; Dosage

19990026377 Department of Energy, Washington, DC USA
Biogenic and biomass burning sources of acetone to the troposphere
Atherton, C. S., Department of Energy, USA; Apr. 01, 1997; 14p; In English
Report No.(s): DE98-051033; UCRL-ID-127304; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Acetone may be an important source of reactive odd hydrogen in the upper troposphere and lower stratosphere. This source of odd hydrogen may affect the concentration of a number of species, including ozone, nitrogen oxides, methane, and others. Traditional, acetone had been considered a by-product of the photochemical oxidation of other species, and had not entered models as a primary emission. However, recent work estimates a global source term of 40-60 Tg acetone/year. of this, 25% is directly emitted during biomass burning, and 20% is directly emitted by evergreens and other plants. Only 3% is due to anthropogenic/ industrial emissions. The bulk of the remainder, 51% of the acetone source, is a secondary product from the oxidation of propane, isobutane, and isobutene. Also, while it is speculated that the oxidation of pinene (a biogenic emission) may also contribute about 6 Tg/year, this term is highly uncertain. Thus, the two largest primary sources of acetone are biogenic emission and biomass burning, with industrial/anthropogenic emissions very small in comparison.
NTIS
Acetone; Troposphere; Biomass; By-Products; Butanes; Photochemical Reactions; Estimates; Combustion

19990026396 Department of Energy, Office of Energy Research, Washington, DC USA
Photosynthetic acclimation to elevated carbon dioxide: Basis for variability among plants ***Final Report, 1 Sep. 1988 - 30 Apr. 1992***
Cure, J., Department of Energy, USA; Mar. 30, 1998; 2p; In English
Report No.(s): DE98-006112; DOE/ER/69010-T2; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The objective of this research was to investigate the acclimation phenomena involved in plants as they adjust to a CO2 enriched atmosphere. Plants were grown under various CO2 concentrations in the controlled chambers of the Duke University Phytotron. Soil nutrients, irradiance, temperature, soil water, and atmospheric relative humidity were controlled. Photosynthesis, leaf structure, leaf biomass of photosynthetic leaves or leaflets and of growth points that are not assimilating CO2 were measured to determine contributions of carbon source tissues to sink tissues. Export and import rates following movement of plants into atmospheres of higher carbon dioxide concentration were specifically examined.
NTIS
Photosynthesis; Acclimatization; Carbon Dioxide; Carbon Dioxide Concentration; Biological Effects; Chemical Effects

19990026397 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA
Urgent need for carbon dioxide sequestration
Lackner, K. S., Department of Energy, USA; Butt, D. P., Department of Energy, USA; Jensen, R., Department of Energy, USA; Ziock, H., Department of Energy, USA; Dec. 31, 1998; 5p; In English
Report No.(s): DE98-006088; LA-UR-98-963; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The danger of global warming has put in question the use of fossil fuels which constitute the most abundant and most reliable energy resource. Meeting the ever growing world demand for cheap energy, while simultaneously achieving the required drastic reduction in CO2 emissions can only be accomplished by actively preventing carbon dioxide generated in the combustion of fuels from accumulating in the atmosphere, i.e. by sequestration. Sequestration is possible and economically viable and is currently the only realistic solution to the dilemma of CO2 emissions. The authors have developed a very promising approach that disposes of carbon dioxide by chemically combining it in an exothermic reaction with readily available minerals to form carbonates. The resulting carbonates are stable solids that are known to be environmentally benign and to be stable on geological time scales. This stands in contrast to most other methods that do not appear to fully solve the long term problem.
NTIS
Carbon Dioxide; Greenhouse Effect; Global Warming; Geochronology; Exothermic Reactions; Fossil Fuels

19990026582 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; Radiation, 1996, Fairbanks, Albania
Contract(s)/Grant(s): NCC2-817; NCC2-940; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

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

19990026583 Scripps Institution of Oceanography, La Jolla, CA USA
Advanced Global Atmospheric Gases Experiment (AGAGE) ***Final Report, 1 Feb. 1990 - 30 Sep. 1998***
Weiss, R. F., Scripps Institution of Oceanography, USA; 1998; 2p; In English
Contract(s)/Grant(s): NAGw-2034; NAG5-4023; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The Advanced Global Atmospheric Gases Experiment (AGAGE) is an ongoing research project, for which the work carried out by the Scripps Institution of Oceanography. Due to the need to complete AGAGE activities specifically funded under NAGW-2034 that had been delayed, a no-cost extension to this grant was obtained, creating an overlap period between the two grants. Because the AGAGE project is continuing, and a Final Project Report is required only because of the change in grant numbers, it is most appropriate to submit for this report the Introduction and Accomplishments sections which appear on pages 1-62 of the October 1998 AGAGE renewal proposal. A copy of the complete proposal is attached.
Author
Atmospheric Composition; Experimentation; Research

19990026596 Department of Energy, Assistant Secretary for Human Resources and Administration, Washington, DC USA
Extraction of semivolatile organic compounds from high-efficiency particulate air (HEPA) filters by supercritical carbon dioxide
Schilling, J. B., Department of Energy, USA; Sep. 30, 1997; 72p; In English
Report No.(s): DE98-004879; ANL/ACL-97/6; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Supercritical fluid extraction (SFE) using unmodified carbon dioxide has been explored as an alternative method for the extraction of semivolatile organic compounds from high-efficiency particulate air (HEPA) filters. HEPA filters provide the final stage of containment on many exhaust systems in US Department of Energy (DOE) facilities by preventing the escape of chemical and radioactive materials entrained in the exhausted air. The efficiency of the filters is tested by the manufacturer and DOE using dioctylphthalate (DOP), a substance regulated by the US Environmental Protection Agency under the Resource Conservation and Recovery Act. Therefore, the filters must be analyzed for semivolatile organics before disposal. Ninety-eight acid, base, and neutral semivolatile organics were spiked onto blank HEPA material and extracted using SFE, Soxhlet, automated Soxhlet, and sonication techniques. The SFE conditions were optimized using a Dionex SFE-703 instrument. Average recoveries for the 98 semivolatile compounds are 82.7% for Soxhlet, 74.0% for sonication, 70.2% for SFE, and 62.9% for Soxtec. Supercritical fluid extraction reduces the extraction solvent volume to 10 - 15 mL, a factor of 20 - 30 less than Soxhlet and more than 5 times less than Soxtec and sonication. Extraction times of 30 - 45 min are used compared to 16 - 18 h for Soxhlet extraction.
NTIS
Carbon Dioxide; Organic Compounds; Supercritical Fluids; Fluid Filters; Extraction; Air Filters

19990026603 Department of Energy, Office of Energy Research, Washington, DC USA
Response of vegetation to carbon dioxide. Field studies of plant responses to elevated carbon dioxide levels 1984
Dec. 31, 1998; 150p; In English
Report No.(s): DE98-006198; DOE/ER/60498-T1-PT.1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In the present study, CO2 enrichment has been applied to sweet potatoes and cowpeas in order to investigate its effect on their growth, physiology, and yield under field condition. Objectives were: (1) to establish at Tuskegee Institute the facilities for growing crops in the field under enriched CO2 atmospheric conditions; (2) to obtain field data on the morphological, physiological, biochemical, growth and yield responses of sweet potatoes and cowpeas to elevated levels of CO2; (3) to determine the effects of elevated CO2 in the rate of nitrogen fixation of cowpeas; (4) to provide data for a generalized crop growth model for predicting yield of both sweet potatoes and cowpeas as a function of atmospheric CO2 enrichment.
NTIS
Vegetation; Carbon Dioxide; Carbon Dioxide Concentration; Biological Effects

19990026681 Department of Energy, Office of Energy Research, Washington, DC USA

Real-time mass spectrometry of individual airborne bacteria

Whitten, W. B., Department of Energy, USA; Gieray, R. A., Department of Energy, USA; Reilly, P. T. A., Department of Energy, USA; Yang, M., Department of Energy, USA; Ramsey, J. M., Department of Energy, USA; Aug. 31, 1997; 11p; In English; 1st; Biological mass spectrometry

Report No.(s): DE97-009377; CONF-9707102-2; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A method for the real-time detection of individual bacteria is described. Airborne bacteria and bacterial spores are directly sampled by laser ablation in an ion trap mass spectrometer with an atmospheric pressure inlet system. either positive or negative ion mass spectra can be obtained. Ions of a particular value of m/z can be further characterized by tandem mass spectrometry in the ion trap. Spectra averaged from several hundred individual bacteria of the same species appear to differ somewhat from spectra of bacteria of other species and to be readily distinguishable from spectra of nonbiological particles.

NTIS

Real Time Operation; Mass Spectroscopy; Bacteria; Airborne Infection

46
GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism. For space radiation see 93 Space Radiation.

19990025236 NASA Goddard Space Flight Center, Greenbelt, MD USA

Pressure Measurements Using an Airborne Differential Absorption Lidar, Part 1, Analysis of the Systematic Error Sources

Flamant, Cyrille N., Maryland Univ., USA; Schwemmer, Geary K., NASA Goddard Space Flight Center, USA; Korb, C. Laurence, NASA Goddard Space Flight Center, USA; Evans, Keith D., Maryland Univ. Baltimore County, USA; Palm, Stephen P., Science Systems and Applications, Inc., USA; Jan. 01, 1999; 51p; In English

Contract(s)/Grant(s): NAG5-1782; RTOP 460-28-40; RTOP 460-21-46; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Remote airborne measurements of the vertical and horizontal structure of the atmospheric pressure field in the lower troposphere are made with an oxygen differential absorption lidar (DIAL). A detailed analysis of this measurement technique is provided which includes corrections for imprecise knowledge of the detector background level, the oxygen absorption fine parameters, and variations in the laser output energy. In addition, we analyze other possible sources of systematic errors including spectral effects related to aerosol and molecular scattering interference by rotational Raman scattering and interference by isotopic oxygen fines.

Author

Remote Sensing; Atmospheric Pressure; Pressure Measurement; Vertical Distribution; Differential Absorption Lidar; Raman Spectra

19990025280 Massachusetts Inst. of Tech., Cambridge, MA USA

Laboratory Studies of the Stratospheric Effects of Rocket Exhaust ***Final Report, 1 Jan. 1996 - 31 Dec. 1998***

Molina, M. J.; Haider, M.; Mantz, Y.; Gutzwiller, L.; Molina, L. T.; Dec. 1998; 29p; In English

Contract(s)/Grant(s): F49620-96-1-0034; AF Proj. 2303

Report No.(s): AD-A359201; AFRL-SR-BL-TR-99-0002; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The most important chlorine activation reaction that takes place in the stratosphere is the heterogeneous reaction of chlorine nitrate with hydrogen chloride to produce molecular chlorine and nitric acid. The reaction is catalytic, promoted by surfaces that are not themselves affected by the reaction. This process was investigated in the laboratory: the reaction probability was found to have a value of about 0.02 on glass, on laboratory alumina, and on alumina particles emitted by solid rocket motors. The reaction probability on ice surfaces has a value larger than 0.2 and a negligible value on halocarbon wax or Teflon surfaces. The measurements were carried out under reactant partial pressure, temperature and humidity conditions covering those that are encountered in the mid-latitude lower stratosphere. The reaction mechanism appears do be determined by the water layers adsorbed on the solid surface. Measurements of the amount of water taken up by alumina surfaces were also carried out; the results indicate that under stratospheric conditions several water layers will indeed cover the alumina surfaces.

DTIC

Aluminum Oxides; Rocket Exhaust; Nitrates; Chemical Reactions; Chlorides; Chlorine

19990025295 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Space-Time Integrity of Improved Stratospheric and Mesospheric Sounder and Microwave Limb Sounder Temperature Fields at Kelvin Wave Scales

Stone, E. M., Iowa State Univ. of Science and Technology, USA; Stanford, J. L., Iowa State Univ. of Science and Technology, USA; Ziemke, J. R., Iowa State Univ. of Science and Technology, USA; Allen, D. R., Iowa State Univ. of Science and Technology, USA; Taylor, F. W., Oxford Univ., UK; Rodgers, C. D., Oxford Univ., UK; Lawrence, B. N., Oxford Univ., UK; Fishbein, E. F., Jet Propulsion Lab., California Inst. of Tech., USA; Elson, L. S., Jet Propulsion Lab., California Inst. of Tech., USA; Waters, J. W., Jet Propulsion Lab., California Inst. of Tech., USA; Jul. 20, 1995; ISSN 0148-0227; 8p; In English

Contract(s)/Grant(s): NAGw-2582; NAG5-2787

Report No.(s): Paper-95JD-01171; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Space-time analyses, which are sensitive to details of retrieval and gridding processes not seen in zonal and time means, are used to investigate the integrity of version 8 gridded retrieved temperatures from the improved stratospheric and mesospheric sounder (ISAMS) on the upper atmosphere research satellite (UARS). This note presents results of such analyses applied to ISAMS tropical data. Comparisons are made with microwave limb sounder (MLS), also on UARS, temperatures. Prominent zonal wave number 1 features are observed with characteristics similar to those expected for Kelvin waves. Time versus longitude plots reveal quasi-regular eastward phase progression from November 1991 to mid-January 1992. The perturbations extend throughout the upper stratosphere and lower mesosphere (attitudes of 32-64 km), exhibiting peak-to-peak amplitudes of up to 2deg-3deg K and periods from approximately 2 weeks in midstratosphere to approximately 1 week at higher attitudes. Faster Kelvin waves with periods of 3-5 days are also found in the lower mesosphere. Height versus time plots reveal downward phase and upward group velocities, consistent with forcing from below. Vertical wavelengths are approximately 20 km for the slower mode and about twice this scale for the faster 3 to 5-day mode. The features are trapped within +/-10deg-15deg of the equator. Kelvin wave signatures in ISAMS and MLS temperatures are compared at 10 and 1 hPa. Good agreement is found, illustrating the internal consistency and ability of both ISAMS and MLS temperature grids to capture relatively small amplitude features with space-time scales of fast, zonally asymmetric equatorial modes.

Author

Kelvin Waves; Microwave Sounding; Mesosphere; Stratosphere; Temperature Distribution; Microwave Landing Systems

19990025338 NASA Goddard Space Flight Center, Greenbelt, MD USA

Effect of Particle Non-Sphericity on Satellite Monitoring of Drifting Volcanic Ash Clouds

Krotkov, Nicholay A., Raytheon STX Corp., USA; Flittner, D. E., Arizona Univ., USA; Krueger, A. J., NASA Goddard Space Flight Center, USA; Kostinski, A., NASA Goddard Space Flight Center, USA; Riley, C., Michigan Technological Univ., USA; Rose, W., Michigan Technological Univ., USA; Journal of Quantitative Spectroscopy and Radiative Transfer; Dec. 15, 1998; 27p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Volcanic eruptions loft gases and ash particles into the atmosphere and produce effects that are both short term (aircraft hazards, interference with satellite measurements) and long term (atmospheric chemistry, climate). Large (greater than 0.5mm) ash particles fall out in minutes [Rose et al, 1995], but fine ash particles can remain in the atmosphere for many days. This fine volcanic ash is a hazard to modem jet aircraft because the operating temperatures of jet engines are above the solidus temperature of volcanic ash, and because ash causes abrasion of windows and airframe, and disruption of avionics. At large distances(10(exp 2)-10(exp 4) km or more) from their source, drifting ash clouds are increasingly difficult to distinguish from meteorological clouds, both visually and on radar [Rose et al., 1995]. Satellites above the atmosphere are unique platforms for viewing volcanic clouds on a global basis and measuring their constituents and total mass. Until recently, only polar AVHRR and geostationary GOES instruments could be used to determine characteristics of drifting volcanic ash clouds using the 10-12 micron window [Prata 1989; Wen and Rose 1994; Rose and Schneider 1996]. The NASA Total Ozone Mapping Spectrometer (TOMS) instruments aboard the Nimbus-7, Meteor3, ADEOS, and Earth Probe satellites have produced a unique data set of global SO2 volcanic emissions since 1978 (Krueger et al., 1995). Besides SO2, a new technique has been developed which uses the measured spectral contrast of the backscattered radiances in the 330-380nm spectral region (where gaseous absorption is negligible) in conjunction with radiative transfer models to retrieve properties of volcanic ash (Krotkov et al., 1997) and other types of absorbing aerosols (Torres et al., 1998).

Derived from text

Volcanoes; Atmospheric Chemistry; Clouds (Meteorology); Ashes; Satellite Observation; Volcanology

19990025566 Virginia Univ., School of Engineering and Applied Science, Charlottesville, VA USA

Physical and Chemical Alterations of Ices by Fast Proton Irradiation, Particularly Ozone Synthesis

Atteberry, Christopher L.; Jan. 07, 1999; 73p; In English

Report No.(s): AD-A359111; AFIT-FY99-2; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

In this thesis, we investigated the interaction of 100 keV protons with thin ice films grown under ultra-high vacuum conditions. We determined irradiation of pure water ice produced an upper limit of 0.04 O2/proton that stayed within the film. Determination of this value came from thermally desorbing the films and measuring the O2 released with a quadrupole mass spectrometer. Irradiation of films of solid oxygen, carbon dioxide, hydrogen peroxide, and oxygen/water mixtures led to significant ozone (03) production. We quantified ozone production within the films using thermal desorption and ultraviolet reflectance techniques. Direct irradiation of pure water films did not yield any measurable ozone signal. We compared our results with recent astronomical observations of icy moons in the outer solar system. Molecular oxygen, created and trapped in water ice by 100 keV proton bombardment, seems insufficient to account for the oxygen absorption features (in the visible spectrum) discovered on Ganymede. Ozone produced from oxygen/water mixed-ice films generates a Hartley band (in the ultraviolet) similar in depth to those seen on Ganymede, Rhea, and Dione. The difference in laboratory band position compared with satellite band position suggests the need to revise assumptions concerning the surface ice.

DTIC

Ice; Irradiation; Mass Spectrometers; Proton Irradiation; Solid Cryogens

19990025669 NASA Goddard Space Flight Center, Greenbelt, MD USA

Vertical Distribution of Aerosol in the Troposphere

Spinhirne, James, NASA Goddard Space Flight Center, USA; Hlavka, Dennis, NASA Goddard Space Flight Center, USA; 1999; 1p; In English; Aerosol, 18-22 Jan. 1999, Meribel, France; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The paper addresses the issue of the vertical distribution of aerosol in the troposphere and the relation to causative mechanisms. The focus is on visible wavelength, aerosol extinction cross sections. A background on the state of knowledge will be presented, but the emphasis is on experimental results from several field programs, The GLOBE project (GLobal aerosol Backscatter Experiment) involved a series of flights by the NASA DC-8 throughout the Pacific basin region with comprehensive in situ and multi-spectral lidar aerosol distribution measurements. The data has been extensively analyzed. The results show the existence of a background mode for aerosol loading in the troposphere and a pattern of distribution for transport and boundary layer aerosol for the Pacific region. The ARM (Atmospheric Radiation Measurement) program, operates surface based monitoring sites. For several years at sites in the central great plains and northern coast of Alaska of North America and a site in the tropical western Pacific have been acquiring comprehensive radiation measurements including multispectral aerosol optical thickness and near continuous lidar profiling. Data have been analyzed for typical and special case aerosol events including smoke aerosol from biomass burning for the tropical West Pacific site. Measurements with continuous lidar and multispectral were similarly acquired from a site at Tenerife, Canary Islands during the Aerosol Characterization Experiment and include analysis of the Saharan dust layer. Various measurements will be compared and summarized.

Author

Vertical Distribution; Troposphere; Aerosols; Atmospheric Radiation; Scattering Cross Sections; Pacific Ocean

19990025753 Naval Postgraduate School, Monterey, CA USA

A Comparison of Bulk Aerodynamic Methods for Calculating Air-Sea Flux

Eleuterio, Daniel Patrick; Dec. 1998; 91p; In English

Report No.(s): AD-A359032; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The Louis et al. (1982) bulk aerodynamic method for air-sea flux estimates is currently used in mesoscale models such as COAMPS, while the TOGA-COARE method is a state of the art flux parameterization involving recent findings in surface layer meteorology, and has been proposed as a replacement to Louis. The Louis and TOGA-COARE methods were compared to direct observations daring ACE-1. Results from both methods compared well to observations for momentum flux. For sensible and latent heat flux, both methods showed good agreement in low flux regimes and underestimated the fluxes at higher values. Calculation of the transfer coefficients required to match observations indicated that the bulk transfer coefficients do not increase rapidly enough for z/L values less than -0.5. In the high wind regime, the transfer coefficients were very sensitive to static stability. The COARE method was superior to the Louis method for sensible heat flux estimates while the Louis method was better for latent heat flux. A sensitivity test was done to use the COARE roughness length parameterization in the Louis method. This resulted in slight improvement in sensible heat flux estimates for highly convective conditions. Latent heat flux was overestimated by the

modified Louis parameterization in the same manner as the COARE algorithm, indicating that specification of the latent heat roughness length requires further study.
DTIC
Air Water Interactions; Algorithms; Atmospheric Models; Coefficients; Convection; Flux Quantization; Heat Flux; Latent Heat

19990025788 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA
Three-dimensional finite-difference modeling of non-linear ground motion
Jones, E. M., Department of Energy, USA; Olsen, K. B., Department of Energy, USA; Aug. 31, 1997; 10p; In English; Northridge earthquake
Report No.(s): DE97-008888; LA-UR-97-2408; CONF-970896; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

We present a hybrid finite-difference technique capable of modeling non-linear soil amplification from the 3-D finite-fault radiation pattern for earthquakes in arbitrary earth models. The method is applied to model non-linear effects in the soils of the San Fernando Valley (SFV) from the 17 January 1994 M 6.7 Northridge earthquake. 0-7 Hz particle velocities are computed for an area of 17 km by 19 km immediately above the causative fault and 5 km below the surface where peak strike-parallel, strike-perpendicular, vertical, and total velocities reach values of 71 cm/s, 145 cm/s, 152 cm/s, and 180 cm/s, respectively. Selected Green's functions and a soil model for the SFV are used to compute the approximate stress level during the earthquake, and comparison to the values for near-surface alluvium at the US Nevada Test Site suggests that the non-linear regime may have been entered. We use selected values from the simulated particle velocity distribution at 5 km depth to compute the non-linear response in a soil column below a site within the Van Norman Complex in SFV, where the strongest ground motion was recorded. Since site-specific non- linear material parameters from the SFV are currently unavailable, values are taken from analyses of observed Test Site ground motions. Preliminary results show significant reduction of spectral velocities at the surface normalized to the peak source velocity due to non-linear effects when the peak velocity increases from 32 cm/s (approximately linear case) to 64 cm/s (30-92%), 93 cm/s (7-83%), and 124 cm/s (2-70%). The largest reduction occurs for frequencies above 1 Hz.
NTIS
Three Dimensional Models; Finite Difference Theory; Earthquakes

19990025898 Colorado Univ., Dept. of Astrophysical, Planetary, and Atmospheric Sciences, Boulder, CO USA
Dynamical and Chemical Behavior of the Lower Stratosphere and Interactions with the Troposphere
Salby, Murry L., Colorado Univ., USA; 1999; 2p; In English
Contract(s)/Grant(s): NAGw-3485; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Equivalent-barotropic calculations, in tandem with Lagrangian analyses, reveal how changes of total ozone follow from vertical and horizontal transport by planetary waves. Those calculations also throw light on how diabatic motions comprising the Brewer-Dobson circulation develop from quasi-horizontal advection by planetary waves. Potential temperature along a material surface indicates organized subsidence inside the polar-night vortex, resembling tracer observations from UARS. Lagrangian histories illustrate that this sinking motion follows in large part from parcels being driven out of thermodynamic equilibrium by planetary waves, especially at high latitudes. Irreversible heat transfer then produces a net drift of air across isentropic surfaces as parcels orbit about the displaced vortex. by driving mean-meridional overturning in the stratosphere, this downward drift is ultimately responsible for transferring ozone from the tropics to the extratropical lower stratosphere. It also introduces horizontal structure into the distribution of total ozone, which surfaces clearly in ozone trends. High-resolution global cloud imagery constructed from 6 satellites simultaneously observing the Earth was used to investigate the spectrum of equatorial waves generated by tropical convection and propagating vertically into the stratosphere. The results indicate that temperature variability is dominated by planetary-scale equatorial waves like the Kelvin mode, which agrees with satellite observations of the tropical stratosphere. However, the Kelvin mode accounts for only about 30 - 50% of the eastward momentum flux radiating into the stratosphere, the remainder coming from gravity waves. An algorithm was developed to determine 3-dimensional atmospheric motion from satellite tracer measurements. Based on Lagrangian constraints, the algorithm circumvents limitations of the traditional scheme for inferring motion from temperature measurements and determines the circulation in the tropics as reliably as elsewhere. A study of deep convection revealed that the highest towers (those penetrating into stratospheric air and controlling tropopause height and composition through convective mixing) occur in close association with the diurnal cycle of convection. Clouds colder than 220 K develop almost entirely in association with the diurnal cycle of convection over tropical landmasses and substantially in association with it even over maritime regions.
Derived from text
Atmospheric Circulation; Stratosphere; Troposphere; Computation; Barotropism; Chemical Reactions; Thermodynamic Equilibrium

19990025926 Florida State Univ., Geophysical Fluid Dynamics Inst., Tallahassee, FL USA
Nonlinear Methods Applied to Atmospheric Prediction ***Final Report, 1 May 1996 - 30 Jun. 1998***
Pfeffer, Richard L.; Jul. 06, 1998; 21p; In English
Contract(s)/Grant(s): F49620-96-1-0172
Report No.(s): AD-A359440; AFRL-SR-BL-TR-99-0017; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Although our research grant was terminated prematurely, we were rather productive in research and publication under AFOSR Grant F49620-96-1-0172. As detailed in section 8 of the Final Report, eleven papers have been published or accepted for publication, three others have been submitted, and six more are in various stages of completion based on research supported entirely or in part by this grant. During the grant period, the principal investigator, Professor Richard Pfeffer, was named Distinguished Research Professor by Florida State University. Also a special issue of the scientific journal Dynamics of Atmospheres end Oceans was dedicated to the scientific end administrative accomplishments of Professor Pfeffer. Significant technology transitions were accomplished, as detailed in Section 8 of the Final Report. The results of our research include: (1) the determination of certain limitations on the applicability of the averaging method to problems in which the underlying chaotic attractor (e.g., the Lorenz attractor) consists of motions around two different equilibrium points in planes that are at an angle to each other in phase space. This work is reported in Section 2a of the Final Report. (2) the determination of the profound influence of meridional shear on the growth and nonlinear life cycles of synoptic-scale atmospheric disturbances, and also on the onset of blocking. Our analytic studies on this subject, completed under this grant, all of which have relevance to the forecast problem, are reported in Section 2b of the Final Report. (3) the success of a pilot study in statistical weather prediction of precipitation reported in Section 3 of the Final Report.
DTIC
Weather Forecasting; Atmospheric Pressure; Annual Variations

19990026013 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Baroclinic Wave Variations Observed in MLS Upper Tropospheric Water Vapor
Stone, Elizabeth M., National Center for Atmospheric Research, USA; Randel, William J., National Center for Atmospheric Research, USA; Read, William G., Jet Propulsion Lab., California Inst. of Tech., USA; Waters, Joe W., Jet Propulsion Lab., California Inst. of Tech., USA; Geophysical Research Letters; 19980205; ISSN 0094-8534; Volume 23, No. 21, pp. 2967-2970; In English; Original contains color illustrations
Contract(s)/Grant(s): NAGw-16215; NAGw-18181; NAG5-2787
Report No.(s): Paper-96GL02576; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Upper tropospheric water vapor measurements from the UARS Microwave Limb Sounder are used to investigate the structure and evolution of eastward traveling medium-scale wave features in Southern Hemisphere summertime. The extratropical Southern Hemisphere summer circulation pattern is frequently dominated by medium scale waves which exhibit life cycles of baroclinic growth and barotropic decay. The water vapor field during such life cycles is examined here and found to be well correlated with meteorological fields derived from European Centre for Medium Range Weather Forecasts global analyses. From mid January to mid February 1992 several episodes of growth and decay in the amplitude of eastward traveling waves are found in the water vapor and meteorological data at levels of the upper troposphere, with zonal waves four, five and six being predominant modes. The water vapor data are compared with derived potential vorticity (PV) fields, with strong anticorrelation observed in middle and high latitudes. The results are consistent with model paradigms for the structure and evolution of baroclinic disturbances, coupled with the known characteristics of high PV and low water vapor mixing ratios in lower stratospheric air parcels and the reverse for upper tropospheric air.
Author
Baroclinic Waves; Water Vapor; Upper Atmosphere; Microwave Sounding; Stratosphere; Meteorological Parameters

19990026014 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
The 4-Day Wave as Observed from the Upper Atmosphere Research Satellite Microwave Limb Sounder
Allen, D. R., Iowa State Univ. of Science and Technology, USA; Stanford, J. L., Iowa State Univ. of Science and Technology, USA; Elson, L. S., Jet Propulsion Lab., California Inst. of Tech., USA; Fishbein, E. F., Jet Propulsion Lab., California Inst. of Tech., USA; Froidevaux, L., Jet Propulsion Lab., California Inst. of Tech., USA; Waters, J. W., Jet Propulsion Lab., California Inst. of Tech., USA; Journal of Atmospheric Sciences; Feb. 01, 1997; Volume 54, No. 3, pp. 421-434; In English
Contract(s)/Grant(s): NAG5-2787; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The ”4-day wave” is an eastward moving quasi-nondispersive feature with period near 4 days occurring near the winter polar stratopause. This paper presents evidence of the 4-day feature in Microwave Limb Sounder (MLS) temperature, geopotential height, and ozone data from the late southern winters of 1992 and 1993. Space-time spectral analyses reveal a double-peaked tem-

perature structure consisting of one peak near the stratopause and another in the lower mesosphere, with an out-of-phase relationship between the two peaks. This double- peaked structure is reminiscent of recent three-dimensional barotropic/baroclinic instability model predictions and is observed here for the first time. The height variation of the 4-day ozone signal is shown to compare well with a linear advective-photochemical tracer model. Negative regions of quasigeostrophic potential vorticity (PV) gradient and positive Eliassen-Palm flux divergence are shown to occur, consistent with instability dynamics playing a role in wave forcing. Spectral analyses of PV derived from MLS geopotential height fields reveal a 4-day signal peaking near the polar stratopause. The three-dimensional structure of the 4-day wave resembles the potential vorticity ”charge” concept, wherein a PV anomaly in the atmosphere (analogous to an electrical charge in a dielectric Material) induces a geopotential field, a vertically oriented temperature dipole, and circulation about the vertical axis.
Author
Microwave Sounding; Geopotential Height; Ozone; Stratopause; Upper Atmosphere Research Satellite (UARS); Atmospheric Temperature; Waves; Microwave Landing Systems

19990026043 Scripps Institution of Oceanography, Inst. of Geophysics and Planetary Physics, La Jolla, CA USA
Broadband Seismic Characterization of the Arabian Shield ***Final Report, 10 Aug. 1995 - 9 Nov. 1997***
Vernon, Frank L., Scripps Institution of Oceanography, USA; Berger, Jonathan, Scripps Institution of Oceanography, USA; Oct. 07, 1998; 46p; In English
Contract(s)/Grant(s): F19628-95-K-0015; AF Proj. DENN
Report No.(s): AD-A358582; AFRL-VS-HA-TR-98-0052; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

From November 1995 to March 1997 a total of nine broadband temporary stations were deployed across the Saudi Arabian shield. These stations consisted of STS-2 seismometers that recorded continuously at 40 sps on Refraction Technology RT72A-07 dataloggers. All installations were at bedrock sites. The results from our field deployment of nine portable broadband stations suggest that sites in the Arabian shield are extremely quiet with ground noise near or equal to the low-noise model in the frequency band from 1-10 Hz at the stations RAYN, AFIF, and HALM. All stations matched the low noise model for periods between 2 seconds and twenty second period. The low noise also contributes to the very low detection threshold at these stations of events with mb=3.5 at distances from 10 to 100 degrees. These stations appear to be among the best sites in the world for the properties of detection thresholds and ground noise levels. Seismograms from sources 10 degrees from the center of the network have unique characteristics which can be used to identity the source regions. Zagros events have a clear Pn and Sn arrivals with an observable Lg. Shallow events from the Arabian Sea have clear P, S, and surface waves but no discernible Lg phases. From the opposite direction, aftershocks from the Gulf of Aqaba have very weak P and S waves with very strong Lg phases.
DTIC
Bedrock; Broadband; Deployment; Detection; Earthquakes; Frequencies; Space Transportation System 2 Flight

19990026075 Alabama Univ., Dept. of Physics, Huntsville, AL USA
Kinetic Space Weather: Toward a Global Hybrid Model of the Polar Ionosphere-Lower Magnetosphere Plasma Transport ***Final Report, 1 Mar. 1995 - 28 Feb. 1996***
Horwitz, James L., Alabama Univ., USA; 1996; 2p; In English
Contract(s)/Grant(s): NAGw-4500; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

During the indicated period of performance, we had a number of publications concerned with kinetic polar ionosphere-lower magnetosphere plasma transport. For the IUGG 1991-4 Quadrennial Report, we reviewed aspects of U.S. accomplishments concerned with polar plasma transport, among other issues. In another review, we examined the computer simulations of multiple-scale processes in space plasmas, including polar plasma outflow and transport. We also examined specifically multiscale processes in ionospheric outflows. We developed a Generalized Semi-Kinetic(GSK) model for the topside-lower magnetosphere which explored the synergistic action of wave heating and electric potentials in the formation of auroral Ion conics, in particular the ”pressure cooker” mechanism. We extended the GSK model all the way down to 120 km and applied this code to illustrate the response of the ionosphere- magnetosphere to soft-electron precipitation and convection-driven frictional ion heating, respectively. Later, the convection-driven heating work was extended to a paper for the Journal of Geophysical Research. In addition to the above full published papers, we also presented the first developments of the coupled fluid-semikinetic model for polar plasma transport during this period. The results from a steady-state treatment were presented, with the second presentation being concerned with the effects of photo-electrons on the polar wind, and the first garnering an outstanding student paper award from the American Geophysical Union. We presented the first results from a time-dependent version of this coupled fluid-semikinetic model.
Derived from text
Weather; Kinetics; Computerized Simulation; Climate Models; Heating; Convective Heat Transfer

19990026080 NASA Goddard Space Flight Center, Greenbelt, MD USA

Modeling of the Magnetosphere-Ionosphere-Atmosphere System ***Final Report, 15 Apr. - 15 Oct. 1998***

1998; 2p; In English

Contract(s)/Grant(s): NAG5-7258; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This grant covered the transition period between the ISTP/GGS main mission MAMI work (NAGW5-1097) to the extended mission of GGS/SolaxMax. During this period we concentrated on the following subjects: (1) Ionospheric modeling and in particular the coupling of the ionosphere and the magnetosphere require knowledge of the ionospheric conductances. We have an algorithm to derive these conductances from POLAR UVI or POLAR VIS images. The image analysis requires carefully calibrated measurements, separation of auroral brightness from scattered solar EUV and emissions caused by photoelectrons, and modeling of the auroral conditions, Under this grant we evaluated the various sources of uncertainty that contribute to the conductance calculation by comparing different model approaches and we conducted sensitivity studies. A joint modeling effort between our ionospheric models and a global MHD magnetospheric model with S. Slinker and J. Fedder lead to improved parameterizations for the MHD model. The predictions of that new model were validated using data from ground based instruments, POLAR UVI images, and DMSP satellites. These findings were presented at the GEM meeting in Snowmass, and at the Huntsville modeling workshop in Guntersville. A manuscript for publication is in preparation. A study to evaluate the thermospheric effects of large substorms and storms was con- ducted with the TIE-GCM model. of particular interest are compositional changes of the thermosphere in the southern hemisphere. Southern hemisphere effects are stronger than those on the northern hemisphere because of the larger offset of the magnetic dipole from the rotational axis. These results were presented at the Huntsville modeling workshop in Guntersville.

Derived from text

Atmospheric Models; Magnetospheres; Earth Ionosphere; Image Analysis; Magnetohydrodynamics; Parameterization

19990026142 Department of Energy, Washington, DC USA

Geological Interpretation of the Structure and Stratigraphy of the A/M Area, Savannah River Site, South Carolina

Wyatt, D., Department of Energy, USA; Aadland, R. K., Department of Energy, USA; Cumbest, R. J., Department of Energy, USA; Stephenson, D. E., Department of Energy, USA; Syms, F. H., Department of Energy, USA; Dec. 31, 1997; 89p; In English

Report No.(s): DE98-054185; WSRC-RP-97-0186; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The geological interpretation of the structure and stratigraphy of the A/M Area was undertaken in order to evaluate the effects of deeper Cretaceous aged geological strata and structure on shallower Tertiary horizons.

NTIS

Geology; Stratigraphy

19990026193 European Office of Aerospace Research and Development, FPO New York, NY USA

Regional Analysis of Former Soviet Union Peaceful Nuclear Explosions Recorded in the Former Soviet Union ***Final Report***

Adushkin, V. CV.; Nov. 11, 1995; 55p; In English

Contract(s)/Grant(s): F61708-94-W-0750

Report No.(s): AD-A359543; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Until the late 80's information on Soviet underground nuclear explosions, let alone seismic recording on Soviet soil, were not generally available to the seismological community. The dramatic changes since then have resulted in access to a wide variety of seismic data from Soviet explosions. In this report we present a data set, unique to the field of seismic verification. The data includes a large number of waveforms from in-country seismological station Borovoye for the Soviet peaceful nuclear explosions with announced yields and origin times, some with physical and mechanical conditions at the test site. The waveforms were recorded by digital station of different types. In this report we have summarized and reviewed information on 122 explosions, and 55 waveforms in this data set, which contains recordings obtained in the course of more than 15 years. As the characteristics of recording instruments were changing during this period of time available information on instrument calibrations is also described and reviewed. We also have attempted to describe the observed peculiarities of P-wave by using a simple source function and magnitude correction which take in attention such parameters as the velocity of longitudinal wave, density, moisture, gas content and depth of explosion. More detail analysis was conducted for the explosions conducted in salt as there is representative sample and they were observed on local distances.

DTIC

U.S.S.R.; Seismology; Underground Explosions; Nuclear Explosions

19990026391 Department of Energy, Washington, DC USA

Faster shot-record depth migrations using phase encoding

Morton, S. A., Department of Energy, USA; Ober, C. C., Department of Energy, USA; Dec. 31, 1998; 4p; In English; Sponsored by Society of Exploration Geophysicists, USA

Report No.(s): DE98-006178; SAND-98-1873C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Phase encoding of shot records provides a means of imaging a number of shots within a single migration. This results in a reduction in the required computation for a complete image, a reduction by the number of shots used in each individual migration, trading this increase in speed for additional noise in the resulting image. Some methods for phase encoding have been shown to limit this noise to a tolerable range when combining several shots, enabling speed ups of a factor of a few. In this paper, the authors present a use of phase encoding which allows faster imaging by an order of magnitude or more, with the additional benefit that the individual migrations can be stopped whenever the answer is good enough. This approach may ultimately render 3-D frequency-domain prestack depth migration cost effective.

NTIS

Migration; Depth; Coding

19990026405 Department of Energy, Washington, DC USA

3D finite-difference seismic migration with parallel computers

Ober, C. C., Department of Energy, USA; Gjertsen, R., Department of Energy, USA; Minkoff, S., Department of Energy, USA; Womble, D. E., Department of Energy, USA; Dec. 31, 1998; 5p; In English; 4th; Mathematical and Numerical Aspects of Wave Propagation, USA

Report No.(s): DE98-004255; SAND-98-0173C; CONF-980626; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The ability to image complex geologies such as salt domes in the Gulf of Mexico and thrusts in mountainous regions is essential for reducing the risk associated with oil exploration. Imaging these structures, however, is computationally expensive as datasets can be terabytes in size. Traditional ray- tracing migration methods cannot handle complex velocity variations commonly found near such salt structures. Instead the authors use the full 3D acoustic wave equation, discretized via a finite difference algorithm. They reduce the cost of solving the apraxial wave equation by a number of numerical techniques including the method of fractional steps and pipelining the tridiagonal solves. The imaging code, Salvo, uses both frequency parallelism (generally 90% efficient) and spatial parallelism (65% efficient). Salvo has been tested on synthetic and real data and produces clear images of the subsurface even beneath complicated salt structures.

NTIS

Seismology; Salt Beds; Three Dimensional Models; Wave Equations; Parallel Computers; Algorithms

19990026413 Department of Energy, Office of Environmental Restoration and Waste Management, Washington, DC USA

Reprocessing of Shallow Seismic Reflection Data to Image Faults Near a Hazardous Waste Site on the Oak Ridge Reservation, Tennessee

Doll, W. E., Department of Energy, USA; Dec. 31, 1997; 12p; In English; Application of geophysics to engineering and environmental problems

Report No.(s): DE98-004121; ORNL/CP-96538; CONF-980336; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Shallow seismic reflection data from Bear Creek Valley on the Oak Ridge Reservation demonstrates that spectral balancing and tomographic refraction statics can be important processing tools for shallow seismic data. At this site, reprocessing of data which had previously yielded no usable CMP stacked sections was successful after application of these processing techniques.

NTIS

Hazardous Wastes; Images; Geological Faults

19990026585 Scripps Institution of Oceanography, La Jolla, CA USA

Main Geomagnetic Field Models from Oersted and Magsat Data Via a Rigorous General Inverse Theory with Error Bounds *Final Report*

Backus, George E., Scripps Institution of Oceanography, USA; Jan. 15, 1999; 4p; In English

Contract(s)/Grant(s): NAG5-2967; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The purpose of the grant was to study how prior information about the geomagnetic field can be used to interpret surface and satellite magnetic measurements, to generate quantitative descriptions of prior information that might be so used, and to use this prior information to obtain from satellite data a model of the core field with statistically justifiable error estimates. The need for

prior information in geophysical inversion has long been recognized. Data sets are finite, and faithful descriptions of aspects of the earth almost always require infinite-dimensional model spaces. by themselves, the data can confine the correct earth model only to an infinite-dimensional subset of the model space. Earth properties other than direct functions of the observed data cannot be estimated from those data without prior information about the earth. Prior information is based on what the observer already knows before the data become available. Such information can be ”hard” or ”soft”. Hard information is a belief that the real earth must lie in some known region of model space. For example, the total ohmic dissipation in the core is probably less that the total observed geothermal heat flow out of the earth’s surface. (In principle, ohmic heat in the core can be recaptured to help drive the dynamo, but this effect is probably small.) ”Soft” information is a probability distribution on the model space, a distribution that the observer accepts as a quantitative description of her/his beliefs about the earth. The probability distribution can be a subjective prior in the sense of Bayes or the objective result of a statistical study of previous data or relevant theories.
Derived from text
Geomagnetism; Models; Data Acquisition; Satellite Observation; Ohmic Dissipation; Magnetic Measurement; Estimating; Error Analysis

19990026647 NASA Goddard Space Flight Center, Greenbelt, MD USA
Results from the 1995 Stratospheric Ozone Profile Intercomparison at Mauna Loa (MLO3)
McPeters, R. D., NASA Goddard Space Flight Center, USA; Hofmann, D. J., National Oceanic Atmospheric Administration, USA; Clark, M., Colorado Univ., USA; Flynn, L., National Environmental Satellite Service, USA; Froidevaux, L., Jet Propulsion Lab., California Inst. of Tech., USA; Gross, M., Hughes STX, Inc., USA; Johnson, B., Colorado Univ., USA; Koenig, G., National Oceanic Atmospheric Administration, USA; Liu, X., Denver Univ., USA; McDermid, S., Jet Propulsion Lab., California Inst. of Tech., USA; McGee, T., NASA Goddard Space Flight Center, USA; Murcray, F., Denver Univ., USA; Newchurch, M. J., Alabama Univ., USA; Oltmans, S., National Oceanic Atmospheric Administration, USA; Parrish, A., Massachusetts Univ., USA; Schnell, R., National Oceanic Atmospheric Administration, USA; Singh, U., Hughes STX, Inc., USA; Tsou, J. J., G and A Technical Software, Inc., USA; Walsh, T., Jet Propulsion Lab., California Inst. of Tech., USA; Zawodny, J. M., NASA Langley Research Center, USA; Dec. 21, 1998; 20p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In August 1995 multiple instruments that measure the stratospheric ozone vertical distribution were intercompared at the Mauna Loa Observatory, Hawaii, under the auspices of the Network for the Detection of Stratospheric Change. The instruments included two UV lidar systems, one from JPL and the other from Goddard Space Flight Center, ECC balloon-sondes, a ground-based microwave instrument, Umkehr measurements, and a new ground-based FTIR instrument. The MLS instrument on the UARS satellite provided correlative profiles of ozone, and there was one close overpass of the SAGE II instrument. The results show that much better consistency among instruments is being achieved than even a few years ago, usually to within the instrument uncertainties. The different measurement techniques in this comparison agree to within +/-10% at almost all altitudes, and in the 20 km to 45 km region most agreed within +/-5%. The results show that the current generation of lidars are capable of accurate measurement of the ozone profile to a maximum altitude of 50 km. SAGE agreed well with both lidar and balloon-sonde down to at least 17 km. The ground-based microwave measurement agreed with other measurements from 22 km to above 50 km. One minor source of disagreement continues to be the pressure-altitude conversion needed to compare a measurement of ozone density versus altitude with a measurement of ozone mixing ratio versus pressure.
Author
Ozone; Stratosphere; Atmospheric Composition; Optical Radar; Infrared Spectra

19990026662 Department of Energy, Office of Energy Research, Washington, DC USA
Seismic studies for Fermilab future collider projects
Lauh, J., Department of Energy, USA; Shiltsev, V., Department of Energy, USA; Nov. 30, 1997; 21p; In English; 5th; Accelerator Alignment, USA
Report No.(s): DE98-051151; FNAL/C-97/383; CONF-9710124; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Ground motion can cause significant beam emittance growth and orbit oscillations in large hadron colliders due to a vibration of numerous focusing magnets. Larger accelerator ring circumference leads to smaller revolution frequency and, e.g. for the Fermilab Very Large Hadron Collider(VLHC) 50-150 Hz vibrations are of particular interest as they are resonant with the beam betatron frequency. Seismic measurements at an existing large accelerator under operation can help to estimate the vibrations generated by the technical systems in future machines. Comparison of noisy and quiet microseismic conditions might be useful for proper choice of technical solutions for future colliders. This article presents results of wide-band seismic measurements at

the Fermilab site, namely, in the tunnel of the Tevatron and on the surface nearby, and in two deep tunnels in the Illinois dolomite which is though to be a possible geological environment of the future accelerators.
NTIS
Research Facilities; Betatrons; Earth Movements; Frequencies; Hadrons; Oscillations; Seismology

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METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

19990025260 New Mexico Inst. of Mining and Technology, Geophysical Research Center, Socorro, NM USA
Development of a Field-Deployable Observational System for Characterizing Lightning in Sprite-Producing Storms ***Final Report, 15 Jun. 1996 - 31 Dec. 1997***
Krehbiel, Paul R.; Nov. 05, 1998; 4p; In English
Report No.(s): AD-A359325; AFRL-SR-BL-TR-99-0014; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
This grant supported the initial development of a deployable system for determining the structure of lightning discharges in three spatial dimensions and time. The purpose of this was to utilize the system to characterize lightning discharges that initiate sprites in the upper atmosphere. The grant also supported observations of sprites themselves using low-light-level video cameras and studies which identified charge transfer occurring within the sprite itself. This work resulted in the first high-speed video observations of sprites and the first recognition that significant charge transfer was occurring in sprites. Finally, it provided partial support for improving dual-polarization radar techniques for observing storms.
DTIC
Storms (Meteorology); Meteorological Radar; Charge Transfer; Lightning

19990025325 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Predicting East Coast Sea Breeze Initiated Convection Near Cape Canaveral, Florida
Kelly, Johnathan L., Air Force Inst. of Tech., USA; Jan. 1998; 59p; In English
Report No.(s): AD-A359007; AFIT-FY99-20; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
Warm season thunderstorms represent a significant threat to daily operations at the USA Air Force's (USAF) Cape Canaveral Air Station (CCAS) and the National Aeronautics and Space Administration's (NASA) Kennedy Space Center (KSC) at Cape Canaveral, Florida. Many of these storms are initiated by the East Coast Sea Breeze (ECSB) which forms over the complex land/sea interface around the Cape. Using data from the 1996-97 warm seasons, 184 sea breeze days were found in the Cape area. to isolate ECSB initiated convection, days were eliminated when outside forcing mechanisms other than the ECSB were indicated. This left 120 days on which only the ECSB affected the area. These days were categorized according to convective activity using NEXRAD reflectivity data and lightning data. The categories were: days when no cells formed along the sea breeze front (NCD), days when cells formed but no cloud-to-ground lightning (CGL) occurred (CD), and days when cells formed and developed into thunderstorms with CGL (LD). Our primary goal was to determine whether one could discriminate between a LD and a CD using 1000 and 1500 UTC radiosonde sounding parameters and surface area-averaged horizontal divergence. Each parameter's ability to forecast a LD versus other days then was assessed. We also documented characteristics of undisturbed ECSB days. Seven stability parameters from the 1000 and 1500 UTC radiosonde soundings were calculated. Results showed that only the K Index at 1000 UTC statistically discriminated a LD from a CD. Relative Humidity (RH) and u and nu wind components from 1000 to 400 mb also were calculated for both sounding times. There were no statistically significant differences in RH between LD and CD at any pressure level for either sounding time. Likewise, the u wind component produced no statistically significant discrimination between the LD and CD categories.
DTIC
Sea Breeze; Convection; Forecasting; Meteorology

19990025380 Utah Univ., Dept. of Meteorology, Salt Lake City, UT USA
Regional Scale Model Climatology of the North American Monsoon System
Swanson, Robert T., Jr., Utah Univ., USA; Dec. 1998; 174p; In English
Report No.(s): AD-A359093; AFIT-FY99-33; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche
The Pennsylvania State University/National Center of Atmospheric Research Mesoscale Model 5 (MM5) is forced by the observed evolution of sea surface temperature and the National Center for Environmental Prediction (NCEP) reanalyses of the atmospheric flow on the lateral boundaries. The MM5 reproduces many of the general features of the large-scale circulation found

in the NCEP reanalyses. It does, however, develop a stronger regional meridional circulation with higher precipitation rates in the Intertropical Convergence Zone (ITCZ), stronger cross-equatorial flow in the boundary layer, and greater divergent flow aloft. The model ITCZ is displaced too far north and tends to be located over the highest sea surface temperature. Mesoscale circulation features, such as diurnal land/sea breezes and gap flows across Mexico and Central America, are captured. The observed latitudinal transition from the shallow planetary boundary layer (PBL) with stratiform clouds over the cool waters of the equatorial Pacific to a relatively deeper PBL further north is simulated by the model. More tropical cyclones develop in the MM5 than were observed and they were comparatively shorter-lived and weaker. Also, the model, as presently configured, does not realistically simulate the year-to-year variations in tropical cyclones. The regional circulation during Summer 1997 was dominated by the planetary-scale El Nino/Southern Oscillation phenomenon. The normally cool waters along the equator were unusually warm with enhanced convection to the south of the mean position of the ITCZ. Large-scale subsidence over Central America and the extreme eastern Pacific Ocean led to drought conditions in that region. The number and intensity of tropical cyclones observed during summer 1997 in the eastern equatorial Pacific were reduced despite the fact that the most intense hurricane of the eight seasons occurred during that year.
DTIC
Scale Models; Climatology; Monsoons; Meteorological Instruments

19990025381 Texas A&M Univ., Dept. of Meteorology, College Station, TX USA
Synoptic Disturbances Found in Precipitable Water Fields North of Equatorial Africa
Patla, Jason E., Texas A&M Univ., USA; Jan. 07, 1999; 111p; In English
Report No.(s): AD-A359094; AFIT-FY99-27; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The origin and structure of tropical synoptic scale precipitable water (PW) anomalies estimated from TOVS satellite observations are analyzed as they propagate eastward across northern Africa during MAM 1988. Previous studies, accomplished by Mackey (1996), determined the location and season for the strongest and most coherent 3 to 8 day filtered PW signal. NCEP/NCAR reanalysis (2.50 resolution) provides data for a case study analysis of seven prominent anomalous PW events during the period. Six case wind field composite analysis is accomplished with both actual winds and reduced shear winds (zonal mean removed at each latitude band). Case study analysis revealed a doppler shifted propagating Rossby Wave (k = 6, c = -5 m/sec) at 500 hPa and 250 hPa that moved onto the west African coast imbedded within a mean zonal flow of approximately 17 m/sec. The wave then moved east across the continent at approximately 12 m/sec near 20 N. The wave's associated cusp-like feature advects deep tropical moisture northward, resulting in Mackey's PW anomaly. Analysis of potential vorticity, specific humidity, temperature, and wind field composites at 850 hPa, 500 hPa and 250 hPa fit well within the range of Rossby wave structure. Descriptive statistical analysis established confidence intervals for the composites at two resolutions within the localized grid (20 W to 40 E, 0 to 30 N). An empirical model is provided showing a four stage development of the PW anomalies during the five primary days of their life cycle and days prior.
DTIC
Water Vapor; Equatorial Atmosphere; Synoptic Meteorology; Equatorial Regions; Atmospheric Sounding

19990025389 NASA Goddard Inst. for Space Studies, New York, NY USA
Cold Reversal on Kodiak Island, Alaska, Correlated with the European Younger Dryas by Using Variations of Atmospheric C-14 Content
Hajdas, Irka, Eidgenoessische Technische Hochschule, Switzerland; Bonani, Georges, Eidgenoessische Technische Hochschule, Switzerland; Boden, Per, Stockholm Univ., Sweden; Peteet, Dorothy M., Lamont-Doherty Geological Observatory, USA; Mann, Daniel H., Alaska Univ., USA; Geology; 1999; 17p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

High-resolution AMS (accelerator-mass-spectrometer) radiocarbon dating was performed on late-glacial macrofossils in lake sediments from Kodiak Island, Alaska, and on shells in marine sediments from southwest Sweden. In both records, a dramatic drop in radiocarbon ages equivalent to a rise in the atmospheric C-14 by approximately 70%. coincides with the beginning of the cold period at 11000 yr B.P. (C-14 age). Thus our results show that a close correlation between climatic records around the globe is possible by using a global signature of changes in atmospheric C-14 content.
Author
Carbon 14; Chronology; Signatures; Time Measurement; Climatology; Glaciers; Alpha Magnetic Spectrometer

19990025449 NASA Goddard Space Flight Center, Greenbelt, MD USA
A Satellite Infrared Technique for Diurnal Rainfall Variability Studies
Anagnostou, Emmanouil, Universities Space Research Association, USA; Journal of Geophysical Research-Atmospheres; 1998; 49p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Reliable information on the distribution of precipitation at high temporal resolution (less than l hour) is essential for understanding the characteristics of convection in a region. Cloud-top infrared (IR) brightness temperatures from geostationary platforms have a weak physical connection to precipitation, however, their high sampling frequency makes them attractive in studying the temporal evolution of cloudiness and convection. On the other hand, microwave-based (MW) observations from lower sampling-frequency polar-orbiting platforms can provide a better physical connection to precipitating hydrometeors. A recent invention in rainfall estimation from a combination of these two sensors involves adjustment of IR estimates using co-existing MW-based precipitation data on a monthly basis. These techniques use the MW data to remove systematic errors in IR rain estimates, while retaining the high sampling frequency of IR observations (approximately every 15-30 minutes). Perhaps of even greater importance to climate and hydrometeorological applications is the separation of mesoscale convective systems into a portion of rain associated with deep convection (hereafter called convective precipitation), and to precipitation falling from more widespread anvil clouds. This current work focuses on estimation of tropical convective and stratiform rainfall. We attempt to answer fundamental questions, such as : is estimation of convective and stratiform precipitation from IR feasible? If so, how accurate can this be? What is the scale dependence of the IR algorithm's performance? to address these questions, quantitative comparisons are performed between coincident IR- and MW-based instantaneous rainfall estimates at the MW 85 Ghz resolution (-12.5 km). Our data set spans a three-month period (January to March, 1996) of MW and IR observations over northern South America (15N-15S and 35W-80W), which includes the Amazon river basin.
Derived from text
Amazon Region (South America); Diurnal Variations; Hydrometeorology; Rain; River Basins; South America; Tropical Regions; Mesoscale Phenomena; Convection; Clouds (Meteorology)

19990025663 NASA Goddard Space Flight Center, Greenbelt, MD USA
Airborne Measurements of Cirrus Reflectance and Heights with Comparison to Polder Observations
Spinhirne, James, NASA Goddard Space Flight Center, USA; Hlavka, Dennis, NASA Goddard Space Flight Center, USA; Hart, William, NASA Goddard Space Flight Center, USA; Duda, David, NASA Goddard Space Flight Center, USA; 1999; 3p; In English; Aerosol, 18-22 Jan. 1999, Meribel, France; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The NASA ER-2 high altitude aircraft cloud observation experiment includes visible, infrared and microwave radiometric imaging of cloud tops and combined lidar profiling of cloud tops. A special instrument is the Tilt Scan CCD Camera (TSCC) for measurements of cloud top multidirectional reflectance and polarization. Data have been acquired on the bi-directional reflectance of cirrus in the FIRE, TOGA/COARE, SUCCESS and WINCE cloud observation experiments. The FIRE, TOGA/COARE and SUCCESS observations include some cases of combined in situ crystal measurements and in all measurements, multispectral visible/IR cirrus microphysics retrievals are possible. The results for bi-directional reflectance for mid-latitude cirrus in the FIRE and SUCCESS missions are consistent with models for complex, multi-type crystal structure. These may be contrasted with tropical cirrus observation for which results are more typical of simple crystal structure. The cirrus multidirectional results may be compared and contrasted with those available from POLDER. In addition, during the WINCE experiment of January 1997 there were several targeted ER-2 for cloud observation underflights of POLDER on ADEOS, Comparison of direct cloud height measurement and multispectral radiometer analysis from ER-2 data with POLDER results are made.
Author
Reflectance; Clouds (Meteorology); Infrared Imagery; Microwave Radiometers; Bidirectional Reflectance; Cloud Height Indicators; Optical Radar; Attitude (Inclination)

19990025757 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Comparisons of Observations by WSR-88D and High Resolution Mobile Doppler Radar in Tornadoes and a Hurricane
Winslow, Jennifer L.; Jan. 1998; 122p; In English
Report No.(s): AD-A359060; AFIT-FY99-41; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This study compares observations from the Doppler on Wheels (DOW) radar and the WSR-88D radars to identify any features that are important to forecasting that the WSR-88D may be missing. WSR-88D and DOW data were compared for the Dimmitt Tornado on 2 June 1995 (during VORTEX 95), the Rolla Tornado on 31 May 1996, and Hurricane Fran on 5-6 September 1996. For Hurricane Fran, the reflectivity features and velocity features were compared. Small scale features in the wind field, believed to be sub-kilometer scale boundary layer rolls were discovered. It has been suggested that these are responsible for some of the small scale intense damage found in the aftermaths of some hurricanes. These rolls were also visible in the KLTX data but were not as well defined. For the two tornado cases the strength (the difference between the maximum inbound velocity and the maxi-

mum outbound velocity) were examined. As expected the strength observed by the WSR-88D was about 50% less than that observed by the DOW. This was compared with predictions of Burgess (1993).
DTIC
Boundary Layers; Doppler Radar; High Resolution; Hurricanes; Velocity Distribution

19990025914 Space and Naval Warfare Systems Command, San Diego, CA USA
Southern Hemisphere Application of the Systematic Approach to Tropical Cyclone Track Forecasting. Part 2. Climatology and Refinement of Meteorological Knowledge Base ***Interim Report, Dec. 1997 - Sep. 1998***
Bannister, Anthony J.; Boothe, Mark A.; Carr, Lester E., III; Elsberry, Russell L.; Sep. 1998; 77p; In English
Report No.(s): AD-A359385; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The preliminary adaptation by Bannister et al. (1997) of the Systematic Approach to tropical cyclone (TC) track forecasting meteorological knowledge base to the Southern Hemisphere has been extended to eight seasons (1990-91 through 1997-98), which includes 145 (90) cyclones in the South Indian (Pacific) region. A total of 3257 synoptic pattern/region classifications could be described in the context of only four synoptic patterns and 11 synoptic regions. Updated track summaries in each pattern/region combination, and the recurring (more than three) environment structure transitions are provided. Refinements in the set of TC-environment transitional mechanisms in the meteorological knowledge base include: (1) new Equatorial Westerly Wind Burst Mechanism; (2) new semi-direct TC interaction equatorward conceptual model; (3) additional variations of the Subtropical Ridge Modulation mechanisms; and (4) further cases of Vertical Wind Shear leading to dramatic TC track changes. These refinements are illustrated with case studies intended to assist the forecaster in recognizing these transitional mechanisms, and thus anticipating TC track changes in the Southern Hemisphere.
DTIC
Meteorology; Weather Forecasting; Climatology; Tropical Storms

19990025962 Pacific-Sierra Research Corp., Santa Monica, CA USA
Worldwide Cloud Prediction Algorithms, ***26 Aug. 1994 - 30 Apr. 1997***
Poehls, Kenneth A.; Crandall, David M.; O'Rourke, Kevin; Heikes, Kenneth E.; Nov. 01, 1998; 70p; In English
Contract(s)/Grant(s): DNA001-94-C-0149
Report No.(s): AD-A359020; PSR-2732; DSWA-TR-97-82; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report describes the major algorithms included in the Worldwide Cloud Prediction Model (WCPM). A lack of data supplied by DSWA precluded code development beyond a feasibility level. The forecast is designed around a unified neural network with weather inputs representing advection, persistence, and evolution of clouds. Cloud observation data is taken from SERCAA level 3 nephanalysis. NOGAPS forecasts are used for the meteorological parameter inputs. The adopted pixel-by-pixel approach assumes that a forecast is possible based solely upon the past, current and approaching clouds. Each pixel is only loosely connected to surrounding pixels through geographic inputs. No formal synoptic weather inputs are employed. The major pieces are the neural network itself and the advection algorithm utilized to locate data in space and time. All other algorithms provide either neural network input or training data. The general form, the training process, and the final input vectors to the neural network are detailed. The persistence and evolution algorithms actually represent the final input choices for specific space time data. Although separately described, there was never any intention that the algorithms would perform as stand alone modules.
DTIC
Algorithms; Clouds (Meteorology); Weather Forecasting; Cloud Physics; Neural Nets

19990026082 Royal Netherlands Meteorological Inst., De Bilt, Netherlands
First Guess TAF-FGTAF Semi-Automation in TAF Production
Jacobs, Albert, Royal Netherlands Meteorological Inst., Netherlands; Aug. 1998; ISSN 0169-1708; 31p; In English
Report No.(s): KNMI-TR-212; ISBN 90-369-2149-X; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The aviation meteorological services (LMD) at the international airport of Schiphol (Amsterdam) in the Netherlands and at the regional civil airports of Groningen, Maastricht and Rotterdam, are responsible for the supply of accurate meteorological information which is necessary for safety and efficiency in aviation. One of the tasks of the LMD concerns the production and distribution of meteorological forecasts. For reasons of efficiency these meteorological reports or bulletins are distributed in coded form, according to predefined TCAO and WMO regulations. Among these products are the METAR - Meteorological Aviation Routine Weather Report - which is provided every half hour and consists of half-hourly observations at the airport, tile TREND which gives very accurate meteorological information at a specific airport and is indispensable for take-off and to touch-down of aircraft within the next 1.5 to 2 hours, and the TAF or the Terminal Aerodrome Forecast which contains a categorical and probabilistic weather forecast for a specific airport. In this report we shell focus on TAFS. In the Netherlands all TAFs for Scliiphol

[AM] and the regional airports of Groningen [GG] Maastricht [BK], and Rotterdam [RD], are produced at one single location, which at the moment is Schiphol. The main purpose for the production of TAFs is to support all aviation traffic. For this reason the main elements to be forecasted in a TAF are divided into four groups: WIND: Mean wind speed, mean wind direction, gust speed, and probability of gusts above a certain level. VISIBILITY: Horizoi-ital visibility (100 m), probability of visibility being below a pre- defined level. WEATHER: Expected significant weather following WMO regulations. Examples are precipitation amounts, rates and type, and probabilistic information on precipitation. CLOUDS: Cloud cover at various flight levels, cloud base height, probability of cloud cover below a predefined level.
Derived from text
Meteorological Services; Air Traffic; Weather Forecasting; Safety; Regulations; Flight Conditions; Cloud Height Indicators; Cloud Cover

19990026114 Royal Netherlands Meteorological Inst., De Bilt, Netherlands
CO2 in Water and Air During ASGAMAGE Concentration Measurements and Consensus Data
Jacobs, M. J., Royal Netherlands Meteorological Inst., Netherlands; Kunz, Gerard J., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; Sprung, Detlev, Max-Planck-Inst. fuer Chemie, Germany; Stoll, Michel H. C., Nederlands Inst. voor Onderzoek der Zee, Netherlands; 1998; ISSN 0169-1708; 31p; In English; Sponsored in part from the European Commission's Marine Science and Technology Programme
Contract(s)/Grant(s): MAS3-CT95-0044
Report No.(s): KNMI-TR-209; ISBN 90-369-2144-9; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

In 1996 the ASGAMAGE program was started. The acronym ASGAMAGE is a contraction of ASGASEX (for air-sea gas exchange), an earlier experiment in the field of air-sea interaction, and MAGE (Marine Aerosol and Gas Exchange), a subgroup of the International Global Atmospheric Chemistry program, IGAC. Four main goals have been defined for ASGAMAGE (Oost and Huebert, 1995; Oost, 1998): (1) to test new methods for the measurement of air-sea fluxes of CO2 and DMS; (2) to compare these methods with established methods for estimating transfer velocities of trace gases over sea; (3) to find relationships between the transport coefficients for the gas fluxes and relevant geophysical parameters; and (4) to investigate whether significant vertical CO2 concentration gradients can exist in the upper meters of the water column. ASGAMAGE involves the co-operation of 14 research groups from Europe, Canada and the USA of America. Measurements were performed at "Meetpost Noordwijk" (MPN), a research platform some 9 km off the Dutch coast in the North Sea (52 deg. 16 min N, 04 deg. 18 min E) and on the UK ship RRS "Challenger" during a cruise in the area near MPN. The experiment consisted of two intensive observation periods, ASGAMAGE-A and ASGAMAGE-B. Many geophysical parameters were determined, and many measurement techniques were applied. The reader is referred to Oost (1998) and to the ASGAMAGE internet site (http://www.knmi.nl/asgamage/) for an overview of the experiment and for a presentation of preliminary results. One of the crucial observations during ASGAMAGE was the measurement of the concentration of CO2 in water and in air at MPN. A combination of these data with measured CO2 fluxes allows the direct determination of the air-to-sea transfer velocity of C02, as described in Jacobs et aL (1997; 1998a). The CO2 concentration measurements were performed by the Royal Netherlands Meteorological Institute (KNMI, The Netherlands), the Max Planck lnstitut fcjr Chemie (MPIC, Germany), the Netherlands Institute for Sea Research (NIOZ, The Netherlands) and the TNO Physics and Electronics Laboratory (TNO-FEL, The Netherlands). A comparison of preliminary results from ASGAMAGE-B at the ASGAMAGE workshop in September 1997 (Oost, 1998) revealed that the measured C02 concentrations agreed only within about 25-30 ppm (Jacobs et aL, 1998b). However, at that time some re-calibrations still had to be carried out. Because of the importance of the C02 concentration data the ASGAMAGE participants agreed to construct a set of consensus C02 concentration data. The present report describes the construction of this set of CO2 concentration data. Data used here are flagged "final" by the individual institutes. The structure of the report is as follows. Chapter 2 describes the experimental set-up used to determine the various concentrations. In Chapter 3 the actual procedure used to construct the consensus data is presented. This listing includes air temperature, sea water temperature and atmospheric preasure, which must be known to convert the units of the observed CO2 concentrations from parts per million by volume (ppm) to milligrams per cubic metre (mg/cu m) of air or water, respectivelly.
Derived from text
Carbon Dioxide; Atmospheric Composition; Water; Atmospheric Chemistry; Carbon Dioxide Concentration; Air Water Interactions

19990026312 Florida Inst. of Tech., Melbourne, FL USA
Student Performance in a Technology-Enhanced Aviation Meteorology Course
Witiw, Michael R., Florida Inst. of Tech., USA; Kelly-Benjamin, Kathleen, Florida Inst. of Tech., USA; Collegiate Aviation Review; September 1997, pp. 33-42; In English; See also 19990026308; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

In recent years, as the presence of technology in the classroom increased, methods for using technology also increased, but at a much slower pace. With this in mind, this study looked to current educational theory for an effective way of employing computer technology in the aviation meteorology classroom. One method that showed promise consisted of coupling technology with advance organizers. Advance organizers are pertinent introductory materials presented to students prior to formal instruction. Their purpose is to provide cognitive anchorage for the ideas that follow in subsequent instruction. In the past, advance organizers have met with mixed success, however, recent research shows that when properly constructed, they can be very effective in increasing students' academic performance. In this study, the effectiveness of computer technology as a means to present advance organizers was studies. The sample consisted of 67 students who received the advance organizers either by technology via computer monitors or by paper hard copy. Students were statistically matched and data were analyzed using multiple analysis of covariance (MANCOVA) and follow-on univariate analyses of covariance (ANCOVA). In this study, statistically significant results showed computer technology to be effective in increasing performance among aviation meteorology students.
Author
Students; Education; Computer Systems Design; Human Performance

19990026395 Department of Energy, Office of Energy Research, Washington, DC USA
Improvements in modeling the microphysical and radiative properties of cirrus clouds using the Regional Atmospheric Modeling System (RAMS) ***Final Report***
Mitchell, D. L., Department of Energy, USA; Koracin, D., Department of Energy, USA; Edwards, J. M., Department of Energy, USA; Dec. 31, 1998; 7p; In English
Report No.(s): DE98-006116; DOE/ER/61775-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The main work activity during this period was the refinement and General Circulation Model (GCM) parameterization of the treatment of ice cloud radiative properties, developed for this project. The treatment has now been rigorously tested and improved, and can now be used with confidence in radiation transfer schemes. The ice Cloud radiation scheme has also proven useful in satellite remote sensing. The radiation scheme differs from others in the thermal infrared, where it is assumed that photon tunneling does not occur for real ice particles (tunneling can be viewed as a process by which photons outside a particle's area-cross section can still be absorbed). Single particle T-matrix and Mie calculations suggest that a particle's ability to capture energy through tunneling depends on surface morphology, with more tunneling the more circular (or less angular) a surface is. This assumption leads to retrievals of mean particle size which are similar to those observed in tropical cirrus by optical imaging probes, whereas retrieved sizes using Mie theory are about 1/3 those predicted by this scheme. The retrieval method requires channels in the 8--9 (micro)m and 11--12 (micro)m ranges. This assumption about tunneling, as well as treating size distributions in the radiation scheme as bimodal, allows retrievals over a broader range of mean particle size than previous schemes permitted, making such size retrievals applicable to most types of cirrus clouds.
NTIS
Atmospheric General Circulation Models; Radiative Transfer; Cirrus Clouds; Infrared Radiation; Cloud Physics; Climate Change

19990026601 Department of Energy, Office of Financial Management and Controller, Washington, DC USA
Statistical cloud coverage as a function of cloud optical thickness
Brower, K. L., Department of Energy, USA; Jul. 31, 1998; 42p; In English
Report No.(s): DE98-006275; SAND-98-1694; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The time-averaged, daylight fractional statistical cloud coverages as a function of cloud optical thickness and selected values of cloud transmission were determined for various geographic areas using D1 data from the International Satellite Cloud Climatology Project (ISCCP). The regions of interest chosen for this report are: global earth, global sea, global land, global coast, and the six 30 deg-latitude bands over sea, over land, and over coast with longitude 0 deg--360 deg. This statistical information is deduced from data determined from satellite measurements of terrestrial, atmospheric and cloud properties by the International Satellite Cloud Climatology Project. In particular the results are based on the ISCCP D1 data base.
NTIS
Clouds (Meteorology); Cloud Physics; Climatology; Optical Thickness; Climate Change

19990026614 Naval Postgraduate School, Monterey, CA USA
Remote Measurement of Aerosol Optical Properties Using the NOAA POES AVHRR during ACE-1, TARFOX and ACE-2
Smith, Peter J.; Dec. 1998; 63p; In English
Report No.(s): AD-A359853; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A radiative transfer algorithm in the solar wavelengths for the NOAA POES AVHRR is presented for the cloud-free, marine atmosphere. This algorithm combines linearized, single-scattering theory with an estimate of bi-directional surface reflectance. Phase functions are parameterized using an aerosol distribution model and the ratio of radiance values measured in channels 1 and 2 of the AVHRR. Automated cloud screening and sun glint removal is included. Retrieved satellite aerosol optical depth (AOD) is compared to surface measured sunphotometer AOD collected during the International Global Atmospheric Chemistry (IGAC) Project's Second Aerosol Characterization Experiment (ACE-2) from June 16 to July 25, 1997. The comparison data set has a correlation coefficient of 0.88 with a standard error of 0.02 at both channel 1 and 2 wavelengths. Regional aerosol properties are examined with an emphasis on the differences between the ACE-1, TARFOX and ACE-2 regions. ACE-1 and ACE-2 regions have strong modes at AOD at around 0.1, but ACE-2 tails toward higher values consistent with urban and dust aerosol intrusion. The TARFOX region has a noticeable mode at AOD around 0.2, but has significant spread of AOD values consistent with the varied aerosol constituents in that area.

DTIC

Aerosols; Advanced Very High Resolution Radiometer; Air Pollution; Radiative Transfer; Optical Properties; Remote Sensing; Atmospheric Chemistry

19990026621 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

The Use of Satellite Microwave Rainfall Measurements to Predict Eastern North Pacific Tropical Cyclone Intensity

West, Derek A.; Jan. 11, 1999; 90p; In English

Report No.(s): AD-A359878; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This proposed study examines the potential use of satellite passive microwave rainfall measurements derived from Special Sensor Microwave/Imager (SSM/I) radiometers onboard the Defense Meteorological Satellite Program (DMSP) constellation to improve eastern North Pacific Ocean tropical cyclone intensity change forecasting techniques. Relationships between parameters obtained from an operational SSM/I-based rainfall measuring algorithm and 12-, 24-, 36-, 48-, 60- and 72-hour intensity changes from best track data records are examined in an effort to identify statistically significant predictors of intensity change. Correlations between rainfall parameters and intensity change are analyzed using tropical cyclone data from three years, 1992 to 1994. Stratifications based upon tropical cyclone intensity, rate of intensity change, climatology, translation, landfall and synoptic-scale environmental forcing variables are studied to understand factors that may affect a statistical relationship between rainfall parameters and intensity change. The predictive skill of statistically significant rainfall parameters is assessed by using independent tropical cyclone data from another year, 1995. In addition, case studies on individual tropical cyclones are conducted to gain insight on predictive performance and operational implementation issues.

DTIC

Tropical Storms; Cyclones; Climatology; Microwave Imagery; Forecasting; Pacific Ocean; Rain; Remote Sensing

19990026648 NASA Goddard Space Flight Center, Greenbelt, MD USA

A TRMM Rainfall Estimation Method Applicable to Land Areas

Prabhakara, C., NASA Goddard Space Flight Center, USA; Iacovazzi, R., Jr., Raytheon STX Corp., USA; Oki, R., Tokyo Univ., Japan; Weinman, J. A., NASA Goddard Space Flight Center, USA; 1998; 47p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Utilizing multi-spectral, dual-polarization Special Sensor Microwave Imager (SSM/I) radiometer measurements, we have developed in this study a method to retrieve average rain rate, R(sub f(sub R)), in a mesoscale grid box of 2deg x 3deg over land. The key parameter of this method is the fractional rain area, f(sub R), in that grid box, which is determined with the help of a threshold on the 85 GHz scattering depression 0 deduced from the SSM/I data. In order to demonstrate the usefulness of this method, nine-months of R(sub f(sub R))are retrieved from SSM/I data over three grid boxes in the Northeastern United States. These retrievals are then compared with the corresponding ground-truth-average rain rate, R(sub g), deduced from 15-minute rain gauges. Based on nine months of rain rate retrievals over three grid boxes, we find that R(sub f(sub R)can explain about 64 % of the variance contained in R(sub g). A similar evaluation of the grid-box-average rain rates R(sub GSCAT) and R(sub SRL), given by the NASA/GSCAT and NOAA/SRL rain retrieval algorithms, is performed. This evaluation reveals that R(sub GSCAT) and R(sub SRL) can explain only about 42 % of the variance contained in R(sub g). In our method, a threshold on the 85 GHz scattering depression is used primarily to determine the fractional rain area in a mesoscale grid box. Quantitative information pertaining to the 85 GHz scattering depression in the grid box is disregarded. In the NASA/GSCAT and NOAA/SRL methods on the other hand, this quantitative information is included. Based on the performance of all three methods, we infer that the magnitude of the scattering depression is a poor indicator of rain rate. Furthermore, from maps based on the observations made by SSM/I on land and ocean we find that there is a significant redundancy in the information content of the SSM/I multi-spectral observations. This leads us to infer that observations of SSM/I at 19 and 37 GHz add only marginal information to that given by 85 GHz

scattering depression. As with other methods, the area-average rain retrieval method developed in this study needs tuning with radar and/or rain gauge observations. In the TRMM mission, the microwave radiometer rain retrieval algorithm can be tuned with TRMM radar observations. Since the radiometer has about 3.5 times wider spatial coverage compared to the radar in the TRMM mission, such an algorithm can be useful to extend geographically the rain information provided by the TRMM Precipitation Radar.
Author
Microwave Imagery; Rain; Mesoscale Phenomena; Precipitation (Meteorology); Radar Tracking; Microwave Radiometers; Meteorological Radar

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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.

19990025281 Woods Hole Oceanographic Inst., MA USA
Water Samplers for Open Ocean Tracer Release Experiments
Donoghue, Terence; Ledwell, James R.; Doherty, Kenneth; Dec. 1998; 49p; In English
Contract(s)/Grant(s): OCE-9020492; OCE-9415598
Report No.(s): AD-A359199; WHOI-98-20; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Conventional ”spot” sampling of patchy distributions of oceanic constituents can lead to sampling errors. Interpretation of results based on data of disparate temporal or spatial resolution can be difficult or impossible. This report discusses the design and performance of two water sampling devices which attempt to minimize these problems. The devices were created for open ocean tracer release experiments, but can be used for other experiments where inhomogeneity is anticipated. The first sampler is a mechanically-operated,variable-rate integrating water sampler which acquires a time-averaged sample. The sampler incorporates features of both the spring-driven and the hydraulically-driven samplers described by Ledwell et al., 1991. The second sampler is a multichamber sampling system incorporating a battery powered pump and valve system made by McLane Research, Inc., of Falmouth, Massachusetts. The system consists of a micro-gear pump, a 50-port valve with programmable controller, and carousels containing fifty glass sampling syringes. It can be programmed to sample on a variety of schedules allowing the user flexibility in the field to adapt to changing requirements. A general description, operational instructions, and performance analysis are provided for each sampler system.
DTIC
Water Sampling; Reliability Analysis; Spatial Resolution; Samplers

19990025922 Washington State Univ., Pullman, WA USA
Wave Groups in Shallow Water ***Final Report, 1 Oct. 1996 - 15 May 1998***
Elgar, Steve; Jan. 15, 1999; 7p; In English
Contract(s)/Grant(s): N00014-90-J-1021
Report No.(s): AD-A359432; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
One of the primary results of this study is that wave group statistics observed in the ocean at depths greater than 10 m for a large range of wave conditions are consistent with linear theory. Wave group prediction models that do not include the effect of correlations between waves separated by several intervening waves underpredict the number of sequential large waves. On the other hand, a model that includes correlations of waves separated by as many as six intervening waves predicts accurately the observed wave group statistics. Another result is that although computationally convenient, wave group prediction models based on power spectral shape alone are not as accurate as models based on direct simulations of the wave field. In shallower water where nonlinearities in the wave field can be important, linear theory based models underpredict the lengths of groups of large waves, but nonlinear simulations that use information from the power spectrum and bispectrum of the time series of sea-surface elevation are more accurate. The simulations suggest nonlinearities result in longer groups of high waves than occur in a Gaussian (eg, linear) sea.
DTIC
Ocean Surface; Time Series Analysis; Shallow Water; Correlation

19990026106 Oregon State Univ., Coll. of Oceanic and Atmospheric Sciences, Corvallis, OR USA

SeaSoar CTD Observations During the Coastal Mixing and Optics Experiment: R/V Endeavor Cruises from 14 August to 1 September 1996 and 25 April to 15 May 1997

O'Malley, R.; Barth, J. A.; Erofeev, A.; Fleischbein, J.; Kosro, P. M.; Oct. 1998; 502p; In English

Contract(s)/Grant(s): N00014-95-1-0382

Report No.(s): AD-A359372; DR-168; No Copyright; Avail: CASI; A22, Hardcopy; A04, Microfiche

Two physical oceanography cruises on the R/V Endeavor were conducted by the co-PIs Jack Barth and Mike Kosro as part of the ONR-sponsored Coastal Mixing and Optics (CMO) Accelerated Research Initiative. The objective was to rapidly survey a region around 40.5N, 70.5W where a set of moorings and a stationary vessel conducting profiling operations were located. The first cruise took place during a period of strong summer stratification (14 August to 01 September 1996); the second cruise was conducted in the following spring (25 April to 15 May 1997) as water over the shelf restratified after mixing by winter storms. The water column was sampled by towing the undulating vehicle SeaSoar from the surface to within 5-7 m of the bottom. The vehicle was equipped with a standard SeaBird 9/11+ CTD sensor to measure conductivity, temperature, and depth; a nine-wavelength light absorption and attenuation meter (WETLabs ac-9); and a new microstructure instrument developed by OSU (MicroSoar) which measured conductivity and temperature at a very high frequency sampling rate using robust, fast-response probes. DTIC

Ocean Data Acquisitions Systems; Ocean Dynamics; Storms; Coasts; Microstructure

19990026426 Department of Energy, Office of Energy Research, Washington, DC USA

Toward an extended-geostrophic Euler-Poincare model for mesoscale oceanographic flow

Allen, J. S., Department of Energy, USA; Newberger, P. A., Department of Energy, USA; Holm, D. D., Department of Energy, USA; Dec. 31, 1998; 34p; In English; Atmosphere and ocean dynamics; Meeting sponsored in part by Isaac Newton Inst.

Report No.(s): DE98-003470; LA-UR-98-202; CONF-971242; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors consider the motion of a rotating, continuously stratified fluid governed by the hydrostatic primitive equations (PE). An approximate Hamiltonian (L1) model for small Rossby number (var-epsilon) is derived for application to mesoscale oceanographic flow problems. Numerical experiments involving a baroclinically unstable oceanic jet are utilized to assess the accuracy of the L1 model compared to the PE and to other approximate models, such as the quasi geostrophic (QG) and the geostrophic momentum (GM) equations. The results of the numerical experiments for moderate Rossby number flow show that the L1 model gives accurate solutions with errors substantially smaller than QG or GM. NTIS

Oceanography; Mesoscale Phenomena; Stratified Flow; Ocean Models

19990026584 Lamont-Doherty Geological Observatory, Palisades, NY USA

Participation in the 1996 Arlindo Cruise to the Indonesian Seas ***Final Report, 1 Jul. 1996 - 30 Jun. 1997***

Marra, John, Lamont-Doherty Geological Observatory, USA; 1997; 2p; In English

Contract(s)/Grant(s): NAGw-5189; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The objective of Arlindo-Productivity is to understand the factors responsible for regional differences in the response of phytoplankton and zooplankton to the SE and NW Monsoons in Indonesia. The hypothesis is that an interplay between circulation and shoaling of the nutricline, as a response to the monsoons, regulates productivity in the Indonesian Seas. My o@jective for the cruise in 1996 was to continue our collaboration with Indonesian scientists by conducting a set of hydrographic, primary production and spectral irradiance observations in the Indonesian Seas. This grant paid for shipping, travel and incidental costs associated with participation in the cruise in December, 1996. Ship costs were borne by the Indonesian Institute of Sciences as part of the collaborative effort. A plan for Arlindo in 1996 was agreed upon in March, 1996, by Indonesian scientists together with Arnold Gordon. The plan called for a 20-day physical oceanography and mooring cruise in November, 1996, followed by a 5-day bio-optical cruise. The bio-optical cruise departed from, and returned to, Ambon, and sampled in the Banda Sea. We completed a series of chlorophyll analyses, both a sampling of surface variability and depth profiles in the Banda Sea. We also completed three MER profiles for depth profiles of spectral irradiance. These data have a useful by-product in that they can be used for vicarious calibration of the OCTS sensor aboard the ADEOS satellite. As such, the data has been transmitted to NASDA in Japan for their use. Author

Phytoplankton; Ocean Dynamics; Chlorophylls; Zooplankton; By-Products; Monsoons

19990026646 NASA Goddard Space Flight Center, Greenbelt, MD USA

Changes in the Radiometric Sensitivity of SeaWiFS

McClain, Charles R., General Sciences Corp., USA; Barnes, Robert A., General Sciences Corp., USA; Eplee, Robert E., Jr., General Sciences Corp., USA; Patt, Frederick S., General Sciences Corp., USA; Applied Optics; Dec. 23, 1998; 40p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We report on the lunar and solar measurements used to determine the changes in the radiometric sensitivity of the Sea-viewing Wide Field-of-view Sensor (SeaWiFS). Radiometric sensitivity is defined as the output from the instrument (or from one of the instrument bands) per unit spectral radiance at the instrument's input aperture. Knowledge of the long-term repeatability of the SeaWiFS measurements is crucial to maintaining the quality of the ocean scenes derived from measurements by the instrument. For SeaWiFS bands 1 through 6 (412 nm through 670 rim), the change in radiometric sensitivity is less than 0.2% for the period from November 1997 through November 1998. For band 7 (765 nm), the change is about 1.5%, and for band 8 (865 nm) about 5%. The rates of change of bands 7 and 8, which were linear with time for the first eight months of lunar measurements, are now slowing. The scatter in the data points about the trend lines in this analysis is less than 0.3% for all eight SeaWiFS bands. These results are based on monthly measurements of the moon. Daily solar measurements using an onboard diffuser show that the radiometric sensitivities of the SeaWiFS bands have changed smoothly during the time intervals between lunar measurements. Since SeaWiFS measurements have continued past November 1998, the results presented here are considered as a snapshot of the instrument performance as of that date.

Author

Ocean Color Scanner; Radiometers; Radiometric Resolution; Sea Surface Temperature; Sea-Viewing Wide Field-Of-View Sensor; Calibrating; Instrument Errors; Diffusers; Sunlight; Lunar Luminescence

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LIFE SCIENCES (GENERAL)

19990025370 NASA Goddard Inst. for Space Studies, New York, NY USA

Oxygen Isotopes in Fresh Water Biogenic Opal: Northeastern US Alleroed-Younger Dryas Temperature Shift

Shemesh, Aldo, Weizmann Inst. of Science, Israel; Peteet, Dorothy, NASA Goddard Inst. for Space Studies, USA; Journal of Geophysical Letters; 1997; 16p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The first oxygen isotope analysis of biogenic opal from lake sediments, from the Allerod/Younger Dryas transition in a core from Linsley Pond, Connecticut, gives an average estimate of a 6 C drop in temperature during the Younger Dryas. This shift represents temperatures during the bloom season, and may be less than the winter temperature drop. The sharp transition itself, with a duration of about 200 years, suggests that the temperature decrease may have been as large as 12 C. Previous estimates of the Allerod/Younger Dryas temperature shifts are controversial, and range from 3-20 C, suggesting that further interdisciplinary research on the same samples is warranted. One way that global climate change manifests itself is by redistributing energy throughout the globe. The Northern Hemisphere latitudinal temperature gradient during the late-glacial is at present a controversial topic. The magnitude of air temperature shifts during the Allerod/Younger Dryas (YD) oscillation are estimated from mid-latitude pollen records surrounding the North Atlantic to be 3-5 C in Europe [Lowe et al., 19941 and 3-4 C in the eastern US [Peteet et al., 1993]. In contrast, lake temperatures estimates derived from aquatic midge larvae in the Canadian eastern maritimes and Maine range from 6-20 C, with larger shifts at more southern sites [Levesque et al., 1997]. The magnitude of YD cooling in Greenland ice cores ranges from at least 7 C from the Bolling warming [Dansgaard et al., 1989] to 15 C - a more recent estimate from borehole temperatures [Cuffey et al., 1995]. The ice core geochemical records reveal that massive frequent and short-term (decadal or less) changes in atmospheric composition occurred throughout this event, suggesting a very dynamic circulation [Mayewski et al., 1993).

Author

Atmospheric Composition; Geochemistry; Glaciers; Periodic Variations; Temperature Gradients; Estimates; Climate Change; Climatology

19990025375 Baylor Coll. of Medicine, Houston, TX USA

The Study of Leukocyte Functions in a Rotating Wall Vessel ***Final Report***

Trial, JoAnn, Baylor Coll. of Medicine, USA; [1998]; 5p; In English

Contract(s)/Grant(s): NCC9-36; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The objective of this study was to investigate the behavior of leukocytes under free-fall conditions in a rotating wall vessel. In such a vessel, the tendency of a cell to fall in response to gravity is opposed by the rotation of the vessel and the culture medium within, keeping the cells in suspension without fluid shear. Previous reports indicated that such functions as lymphocyte migration

through collagen matrix or monocyte cytokine secretion are altered under these conditions, and these changes correlate with similar functional defects of cultured cells seen during spaceflight.
Derived from text
Culture Techniques; Free Fall; Lymphocytes; Immune Systems; Immunology; Endothelium; Microorganisms

19990025652 Prins Maurits Lab. TNO, Rijswijk Netherlands
Set-up of a System to Reliably Measure the Startle Response in Marmoset Monkeys; Application in Animal Models of Anxiety and Psychosis ***Final Report***
Meichers, B.P.; Groen, B.; Vanwersch, R.A.; Philippens, I.H.; Bruijnzeel, P.L.; Jul. 1998; 29p; In English
Report No.(s): AD-A359300; TNO-PML-1998-B42; TDCK-TD98-0082; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The acoustic startle response is a reflex motor response elicited by a sudden loud sound. In two psychiatric disorders, the startle reflex is altered. Normally, the startle response is decreased appreciably when a low intensity sound stimulus is given shortly before the startle eliciting stimulus. This prepulse inhibition of the startle is nearly absent in patients suffering from schizophrenia. In addition, the startle response is increased during periods of anxiety. In this study, a system is described by which the acoustic startle response in marmoset monkeys may be recorded in a reliable way. In using this system, it could be shown that marmosets possess a pre-pulse inhibition (PPI) of the ASR, similar as in other species. Furthermore, it was shown that a fear potentiation of the startle response may be elicited in the marmoset. Potentially, this system may be used for testing anti-psychotic or anxiolytic activity of drugs in primates. In this study, a series of drugs with a known activity on PPI or fear potentiation of the ASR was tested to validate the system. The effects of Buspiron and Diazepam were tested as examples of drugs with a known anxiolytic effect. In addition, Fluvoxamine and Haloperidol were used in these experiments. Amphetamine, Ketamine and Haloperidol were used as drugs to affect the PPI; in these experiments Diazepam was used as a negative control. These experiments were performed in a randomized, cross-over design. In the fear potentiated startle experiments, four animals were used. They received, following a training period to establish a stable baseline fear potentiation, three dose levels of each of the drugs. In addition, the animals were injected with saline S times spread evenly over the total duration of the experiment to test the stability of the baseline fear potentiation. The four animals used in the PPI group were subjected to a similar dosing schedule.
DTIC
Evoked Response (Psychophysiology); Schizophrenia; Psychoses; Monkeys; Fear; Animals; Amphetamines

19990025775 Armed Forces Radiobiology Research Inst., Bethesda, MD USA
Animal Studies of Residual Hematopoietic and Immune System Injury From Low Dose/Low Dose Rate Radiation and Heavy Metals
Yagunov, A. S.; Tokalov, S. V.; Chukhlovin, A. B.; Afanassiev, B. V.; Sep. 1998; 32p; In English
Contract(s)/Grant(s): DNA-001-96-C-0047
Report No.(s): AD-A359088; CR98-3; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The interaction of low dose/low dose rate radiation with heavy metals (in this report cadmium and lead) is important for at least two reasons: 1) radiation workers and populations exposed to unusually high background levels of radiation (e.g. Chernobyl and the Techa river in Russia) receive this type of exposure rather than the much better studied prompt high dose exposure, and 2) radiation accidents frequently involve the release of other contaminants as well. Even at low radiation doses and dose rates, the effects of simultaneous or near simultaneous exposure to cadmium or lead, which are marrow toxicants in their own right, are additive or synergistic to those of radiation. Although there is an adaptive response to low dose rate exposures, recovery of marrow precursor cells after a second exposure may be incomplete. Detection of damage repair changes after low dose exposures is difficult. The authors describe possible mechanisms for the observed delayed or incomplete recovery. They also address the complex pathogenic changes seen when heavy metals are introduced along with the radiation. The implications of their findings in rodent models for human populations are discussed, and the importance and proposed directions of further work in this field described.
DTIC
Background Radiation; Additives; Delay

19990025927 General Accounting Office, National Security and International Affairs Div., Washington, DC USA
DOD Animal Research: Improvements Needed in Quality of Biomedical Research Database
Dec. 1998; 15p; In English; Report to Congressional Committees.
Report No.(s): AD-A359441; GAO/NSIAD/HEHS-99-24; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In 1992, congressional concerns were expressed about the lack of disclosure of the Department of Defense's (DOD) animal use programs and activities. In response, DOD began submitting annual reports to the Congress in 1994. In 1995, to respond to

continued congressional concerns and direction, DOD established the Biomedical Research Database (BRD) containing information on individual research projects and training programs involving animals being conducted by its laboratories, military hospitals and bases, and contractors. House Report 103499, issued by the House Armed Services Committee in its consideration of the National Defense Authorization Act for fiscal Year 1995, directed us to examine several issues related to DOD'S administration of its animal research programs. We are examining the extent to which DOD'S research using animals addresses validated military objectives, does not unnecessarily duplicate work done elsewhere, and incorporates methods to reduce, replace, and refine the use of animals. In the course of doing this work, we identified problems with the quality of information in the BRD. The purpose of this report is to bring these problems to your attention. We are continuing our work on the broader issues and will report the results of our review of DOD'S use of animals in research at a later date.
DTIC
Data Bases; Congressional Reports; Education; Biomedical Data

19990025969 Department of Energy, Office of Energy Research, Washington, DC USA
New tool for protein fold recognition: A Bayesian heuristic threading algorithm
Crawford, O., Department of Energy, USA; Oct. 31, 1997; 12p; In English; 2nd; Computational molecular biology
Report No.(s): DE98-001254; ORNL/CP-95145; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
This paper presents a new threading algorithm, designed to be used in protein fold recognition. Its purpose is to contribute toward the goal of predicting three-dimensional structures of proteins from knowledge of their amino-acid sequences alone. Sequences for new proteins are being discovered at a rapid rate, as a result of the Human Genome Project, and related genome research. Understanding of protein folding, and especially the ability to predict the 3D fold from the sequence, is crucial to the understanding of the function of these new proteins. This is considered by many to be the most important problem in contemporary molecular biology. Numerical tests of the speed and reliability of the algorithm are described, along with comparisons with two popular threading algorithms. For the systems examined, the new method constitutes a significant improvement.
NTIS
Proteins; Folding; Bayes Theorem; Heuristic Methods; Algorithms; Molecular Biology

19990026006 Department of Energy, Office of Energy Research, Washington, DC USA
Energy deposition and radiation quality of radon and radon daughters ***Final Report***
Karam, L. R., Department of Energy, USA; Caswell, R. S., Department of Energy, USA; Sep. 09, 1996; 6p; In English
Report No.(s): DE98-006370; DOE/ER/61599-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
This program was aimed at creating a quantitative physical description, at the micrometer and nanometer levels, of the physical interactions of the alpha particles from radon and its daughters with cells at risk in the bronchial epithelium. The authors calculated alpha-particle energy spectra incident upon the cells and also energy deposition spectra in micrometer- and nanometer-sized sites as a function of cell depth, site size, airway diameter, activities of (sup 218)Po and (sup 214)Po, and other parameters. These data are now being applied, using biophysical models of radiation effects, to predict cell killing, mutations, and cell transformation. The model predictions are then compared to experimental biophysical, biochemical, and biological information. These studies contribute to a detailed understanding of the mechanisms of the biological effectiveness of the radiations emitted by radon and its progeny.
NTIS
Radon; Energy Transfer; Radiation Effects; Biochemistry; Biological Effects

19990026221 Department of Energy, Office of Energy Research, Washington, DC USA
Time resolved laser studies of the proton pump mechanism of bacteriorhodopsin ***Final Report, 1 Apr. 1994 - 31 Mar. 1995***
El-Sayed, M. A., Department of Energy, USA; Dec. 31, 1995; 6p; In English
Report No.(s): DE98-006359; DOE/ER/13828-T5; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
This report summarizes the following research: 'The pH dependence of the subpicosecond retinal photoisomerization process in bacteriorhodopsin: evidence for parallel photocycles,' 'pH dependence of the rate and quantum yield of the retinal photoisomerization in bacteriorhodopsin,' 'Recording of transient grating using the short lived bacteriorhodopsin photocycle intermediates,' 'The C-terminus and the calcium low-affinity binding sites in bacteriorhodopsin,' 'Binding of, and energy-transfer studies from retinal to organic cations in regenerated reduced bacteriorhodopsin,' and 'Binding characteristics of an organometallic cation, Ru(bpy)32+ in regenerated bacteriorhodopsin.'
NTIS
Protons; Research; Bacteria; Energy Transfer; Organometallic Compounds; pH

19990026255 NASA Ames Research Center, Moffett Field, CA USA

Maximum Likelihood Factor Analysis of the Effects of Chronic Centrifugation on the Structural Development of the Musculoskeletal System of the Rat

Amtmann, E., Medizinische Hochschule, Germany; Kimura, T., Teikyo Univ., Japan; Oyama, J., NASA Ames Research Center, USA; Doden, E., Medizinische Hochschule, Germany; Potulski, M., Medizinische Hochschule, Germany; Anatomy and Embryology; 1979; ISSN 0340-2061; Volume 156, pp. 89-101; In English; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A01, Microfiche

At the age of 30 days female Sprague-Dawley rats were placed on a 3.66 m radius centrifuge and subsequently exposed almost continuously for 810 days to either 2.76 or 4.15 G. An age-matched control group of rats was raised near the centrifuge facility at earth gravity. Three further control groups of rats were obtained from the animal colony and sacrificed at the age of 34, 72 and 102 days. A total of 16 variables were simultaneously factor analyzed by maximum-likelihood extraction routine and the factor loadings presented after-rotation to simple structure by a varimax rotation routine. The variables include the G-load, age, body mass, femoral length and cross-sectional area, inner and outer radii, density and strength at the mid-length of the femur, dry weight of gluteus medius, semimenbranosus and triceps surae muscles. Factor analyses on A) all controls, B) all controls and the 2.76 G group, and C) all controls and centrifuged animals, produced highly similar loading structures of three common factors which accounted for 74%, 68% and 68%. respectively, of the total variance. The 3 factors were interpreted as: 1. An age and size factor which stimulates the growth in length and diameter and increases the density and strength of the femur. This factor is positively correlated with G-load but is also active in the control animals living at earth gravity. 2. A growth inhibition factor which acts on body size, femoral length and on both the outer and inner radius at mid-length of the femur. This factor is intensified by centrifugation.

Author

Maximum Likelihood Estimates; Centrifuging; Musculoskeletal System; Rats; Factor Analysis

19990026314 Japan Society of Aerospace and Environmental Medicine, Tokyo, Japan

Japanese Journal of Aerospace and Environmental Medicine, Volume 35

Mano, Tadaaki, Editor, Japan Society of Aerospace and Environmental Medicine, Japan; Ando, Hideki, Editor, Japan Society of Aerospace and Environmental Medicine, Japan; Koga, Kazuo, Editor, Japan Society of Aerospace and Environmental Medicine, Japan; Ohira, Yoshinbu, Editor, Japan Society of Aerospace and Environmental Medicine, Japan; Sugenoya, Junichi, Editor, Japan Society of Aerospace and Environmental Medicine, Japan; Hirayanagi, Kaname, Editor, Japan Society of Aerospace and Environmental Medicine, Japan; Mori, Sigeo, Editor, Japan Society of Aerospace and Environmental Medicine, Japan; Satake, Hirotaka, Editor, Japan Society of Aerospace and Environmental Medicine, Japan; Taya, Yasushi, Editor, Japan Society of Aerospace and Environmental Medicine, Japan; Kakimoto, Yukiko, Editor, Japan Society of Aerospace and Environmental Medicine, Japan; Nakamura, Akio, Editor, Japan Society of Aerospace and Environmental Medicine, Japan; Sudoh, Masamichi, Editor, Japan Society of Aerospace and Environmental Medicine, Japan; June 1998; ISSN 0387-0723; 71p; In English; See also 19990026315 through 19990026319; Original contains color illustrations; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Contents include the following: Day dreaming about human colonization of space should not substitute for basic research on the role of gravity on earth. Influence of microgravity on Mitogen Motility and Cytoskeleton Patterns of T limphocytes and Jarkat cell-experiments on sounding rockets. Rotating systems used as microgravity simulators for studies of Cartilage differentiation. Clinostat rotation promotes HGF/SF-induced morphogenesis of rat pancreatic oval sells. Neuronal responses to vector-averaged gravity: a search for gravisensing and adaptation mechanisms a preliminary report.

CASI

Aerospace Environments; Medical Science; Gravitational Effects; Microgravity; Research; Simulators

19990026315 Nagoya Univ., Space Medicine Research Center, Nagoya, Japan

Day Dreaming About Human Colonization of Space Should not Substitute for Basic Research on the Role of Gravity on Earth

Koga, Kazuo, Nagoya Univ., Japan; Japanese Journal of Aerospace and Environmental Medicine; June 1998; Volume 35, No. 2, pp. 23-26; In English; See also 19990026314

Contract(s)/Grant(s): MOE-10301005; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Day dreaming scientists have been talking about the dream of future space life emphasizing the highlight of them, but never pick up the shadow behind it. It is extremely important to have an basic idea that our behavior in a daily life oil the earth is controlled by the gravity from the cell level to the higher cortical functions as a whole. With using the gravity cue we are controlling our behavior without any consciousness. This has been done not only by an individual personal experience but also by the longitudinal evaluation which has a long historical elapsed time. We have already know many negative aspect of the microgravity to the

human body including not only total body but also the simple cell culturing, such as de-calculations from the bone, disadvantage of cumulative exposure for the space radiation, difficulty of early development for the embryo without gravity, and so on. Life science research is just on the way how the gravity plays all important role to the living organ on the earth. Clinostat experiments gives us a lot of knowledge from the usual cell level experiments in our own laboratory without expecting uncertain flight opportunity and expensive budget. There are several advantages to apply the clinostat rotations to the cell level experiments. One is the extended long term cell biological experiments on the earth with less expensive facilities. Another advantage of the clinostat experiment can be easily put into the daily biology research activities without taking into account the special equipments or facilities comparing with the flight experiments. BY introducing the clinostat method, we can re-evaluate the gravity importance by doing the ground base experiments and test our hypothesis by flowing same schematic experiments under the real microgravity environments.
Author
Extraterrestrial Radiation; Research; Microgravity; Human Body; Gravitational Effects

19990026316 Eidgenoessische Technische Hochschule, Space Biology, Zurich, Switzerland
Influence of Microgravity on Mitogen Binding, Motility and Cytoskeleton Patterns of T Lymphocytes and Jurkat Cells: Experiments on Sounding Rockets
Cogoli-Greuter, Marianne, Eidgenoessische Technische Hochschule, Switzerland; Spano, Alessandra, SASsari Univ., Italy; Sciola, Luigi, SASsari Univ., Italy; Pippia, Proto, SASsari Univ., Italy; Cogoli, Augusto, Eidgenoessische Technische Hochschule, Switzerland; Japanese Journal of Aerospace and Environmental Medicine; June 1998; Volume 35, No. 2, pp. 27-39; In English; See also 19990026314; Original contains color illustrations
Contract(s)/Grant(s): SNRF-31-25181.88; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The effects of microgravity on T lymphocytes and Jurkat cells a T lymphoid cell line was studied on sounding rocket flights with microgravity phases lasting between 1- and 13 minutes. Automated pre programmed instruments permitted the injection of fluorescent labeled concanavalin A, culture medium and,/or fixative at preset times. A microscope, telemanipulated from the ground and connected to a CCD camera permitted to record cell motility and interactions in microgravity. On MAXUS 2, an in flight 1 g - centrifuge allowed the comparison of the data obtained in microgravity with a 1 g control having the same history related to launch and re-entry. Chemically fixed cells were labeled after flight either with monoclonal anti vimentin or anti -tubtulin followed by fluorescent anti-mouse Ig. First, while binding of concanavalin A to the cell membrane is not affected in microgravity, patching of the receptors is significantly retarded in microgravity. Second, cell motiliy and cell-cell contacts are taking place also when cells are free floating in microgravity. Third, marked alterations in the structure of the intermediate filaments of vimentin as well as the microtubules network are observed in microgravity. Most evident is the appearance of large bundles in the vimentin structure, significantly increased in the microgravity samples. These results indicate that direct effects of microgravity on the cytoskeleton are likely whereas little changes occur at the membrane level, and are in agreement with recent data showing that gravity controls the pattern of microtubule formation. The existence of active movements and cell-cell contacts supports but does not prove - the notion that T cells can communicate and transmit signals in microgravity.
Author
Microgravity; Culture Techniques; Gravitation; Lymphocytes

19990026317 Texas Univ., Dept. of Orthodontics and Dentofacial Orthopedics, Houston, TX USA
Rotaing Systems Used as Microgravity Simulators for Studies of Cartilage Differentiation
Duke, Pauline Jackie, Texas Univ., USA; Montufar-Solis, Dina, Texas Univ., USA; Japanese Journal of Aerospace and Environmental Medicine; June 1998; Volume 35, No. 2, pp. 41-54; In English; See also 19990026314
Contract(s)/Grant(s): NIH-RR-05970; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Just as Studies of abnormal chondrogenesis produced by mutation or teratogen add to our understanding of the normal chondrogenic process, studying chondrogenesis in space may assist in 1 g studies of chondrogenic defects. Opportunities to study cartilage differentiation in space, however, are limited, so systems have been developed which can be used at 1 g to simulate microgravity. One model used to mimic effects of microgravity is the clinostat a rotating system which converts gravity from a vector quantity to a scalar quantity. In slow rotating clitiostat systems, cells are attached to a substrate as at 1 g, and rotated with the plane of the culture perpendicular to the gravitational field. Another rotating system used as a microgravity simulator is the Slow Turning Lateral Vessel (STLV) which uses a rotating cylindrical vessel, completely filled with medium to culture cells in suspension without subjecting them to damaging shear forces. Embronic limb cells cultured in the slow rotating clinostat, the STLV, and in space exhibit changes in chondrogenesis related to the stage at which the cells are exposed. Clinorotation decreases the number of nodules in micromass cultures, showing an effect on the condensation process. In micromass cultures flown in space, condensation occurred preflight, so the primary effect of microgravity exposure was on matrix production. In chondrocytes

in the STLV, as in growth plates of spaceflown rats, hypertrophy was decreased. Future clinostat and spaceflight experiments will examine the effect on adhesive molecules and on cytoskeletal organization because of their involvement in the processes that are affected. The mechanisms by which micro-gravity alters phenotype modulation, matrix production and aggregation, and chondrocyte hypertrophy after the cartilage phenotype is established must also be elucidated. The mechanisms resulting in cartilage defects are to a large extent unknown, and microgravitv may provide a way to identify them.
Author
Rotation; Microgravity; Simulators; Cartilage; Gravitational Fields

19990026318 National Cancer Inst., Molecular Oncology Section, Frederick, MD USA
Clinostat Rotation Promotes HGF/SF-Induced Morphogenesis of Rat Pancreatic Oval Cells
Rulong, Shen, National Cancer Inst., USA; Takagishi, Yoshiko, Nagoya Univ., Japan; Koga, Kazuo, Nagoya Univ., Japan; Resau, James H., National Cancer Inst., USA; Inouye, Minoru, Nagoya Univ., Japan; Jeffers, Michael, National Cancer Inst., USA; Rao, Sambasiva M., Nagoya Univ., Japan; Murata, Yoshiharu, Nagoya Univ., Japan; Japanese Journal of Aerospace and Environmental Medicine; June 1998; Volume 35, No. 2, pp. 55-61; In English; See also 19990026314
Contract(s)/Grant(s): MOE-10301005; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The clinostat is a key device to produce a vector averaged gravitational environment which mimic microgravity. NNe studied an effect of vector averaged gravity on branching tubular morphogenesis of rat pancreatic epithelial oval cells treated with hepatocyte growth factor/scatter factor (HGF/SF) using a clinostat. The pancreatic oval cells are believed to be the stem cells for hepatocytes and the pancreatic ductal gland. The cells in the slide flask filled with culture medium containing or not containing HGF/SF were kept on the clinostat to rotate against the gravity direction at 10 or 60 rpm for 72 hours. For the rotational control condition, the cells were subjected to horizontal rotation. The flasks were placed in the same incubator as the stational control condition. The HGF/SF treated oval cells formed branching tubular structures in all conditions including 10 and 60 rpm clinostat. Semithin sections of oval cells embedded in resin showed that these tubular structures contain lumen. Immunofluorescent studies with anti Met anti-body showed intense Met expression along the branching tubular structures. Rhodamine-phalloidin staining showed that F actin is highly involved in tubular branching morphogenesis. These oval cells also showed positive albumin staining, implying that functionally, at least, they are partiallv differentiated toward hepatocytes. In 60 rpm clionstat, however, a more branching and complicated tubular network was formed than in 10 rpm clinostat and rotational/stational controls. It seems that faster rotating clinostat promotes tubular morphogenesis.
Author
Culture Techniques; Rotation; Rhodamine; Microgravity; Gravitational Effects

19990026319 Arizona Univ., Dept. of Physiology, Tucson, AZ USA
Neuronal Responses to Vector-Averaged Gravity: A Search for Gravisensing and Adaptation Mechanism: A Preliminary Report
Gruener, Raphael, Arizona Univ., USA; Japanese Journal of Aerospace and Environmental Medicine; June 1998; Volume 35, No. 2, pp. 63-83; In English; See also 19990026314; Sponsored in part by Japan Dept. of Science; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper serves as a milepost in our work using the climostat as a tool for mimicking certain aspects of altered gravity conditions (vector-nulled gravity) in order to gain insights into the adaptation of cells (and hence organisms) to the microgravity environment of space. I review here recent data, limited to cellular adaptation to altered gravity environments, from others in the field, and including some of our work using the clinostat and from spaceflight experiments. Finally, I report here preliminary results of experiments, carried out initially at Nagoya University's RIENM with follow-up experiments at the University of Arizona. to test the applicability of PC12 cells as neuronal models in which to assess adaptation to altered gravity conditions. PCI2 (phaeochromocytoma) cells were used to examine two central hypotheses. The first is that the ubiquity of the cytoskeletally tethered nucleus of cells serves as a general gravisensing device which may be incidental to its other, more central genomic control role. The second hypothesis is that the clinostat is a useful, earth- bound platform on which to carry out space biology relevant experiments in preparation for testing in space flights. PCI2 cells were triggered to differentiate, into neuron like cells, by the addition of Nerve Growth Factor (NGF) to the culture medium within 4-6 hours after cell plating and just before mounting cultures on the clinostat and control devices. Cultures, in 60 mm or 35 mm polylysine coated dishes, were subjected to clinorotation, centrifugal force, motional controls and shear turbulence control conditions for varying periods. Experiments were carried out at 37 C. Cell morphology (including neurite characteristics) and gene activation were examined. Cytoskeletal integrity was assessed from the staining of tubulin and actin filaments. Confocal microscopy in combination with fluorescence monitoring was undertaken. At this point of the investigation, only preliminary data can be presented. This is due to various technical problems and the need to carrnr out rigor-

ous statistical tests. Still, the preliminary data are of interest because they form the foundation for interpretation against the background of cellular gravisensing and adaptation to gravitational perturbations.
Author
Neurophysiology; Microgravity; Research; Centrifugal Force; Cells (Biology); Culture Techniques; Gravitational Effects

19990026394 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Enzyme catalysts for a biotechnology-based chemical industry ***Quarterly Report, 29 Sep. - 28 Dec. 1997***
Arnold, F. H., Department of Energy, USA; Jan. 15, 1998; 6p; In English
Report No.(s): DE98-006141; DOE/CH/10578-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The goal of this research is to engineer enzymes to be efficient and economically attractive catalysts for the chemical industry. The author is attempting to demonstrate generally-applicable approaches to enzyme improvement as well as develop specific catalysts for potential industrial application. In this report attention is focused on random mutagenesis of pNB esterase -- improved activity and stability. The most thermostable esterases obtained by sequential random mutagenesis (6H7) and random mutagenesis plus recombination (6sF9) each contain 9 amino acid mutations and a number of silent mutations, relative to the wild-type sequence. Eight of the mutations are present in both genes, for a total of ten potentially adaptive mutations. Because several of these mutations occurred in the same generation, it is difficult to identify the mutations responsible for the increases in activity and stability. In order to aid in this identification, the thermostable genes were recombined with the wild-type gene, in hopes of removing neutral mutations. The gene from the first- generation variant, with five amino acid substitutions was also recombined with wild-type.
NTIS
Enzymes; Catalysts; Biotechnology; Chemical Engineering

19990026419 National Inst. of Health, Bethesda, MD USA
Flow cytometry-based DNA hybridization and polymorphism analysis
Cai, H., National Inst. of Health, USA; Kommander, K., National Inst. of Health, USA; White, P. S., National Inst. of Health, USA; Nolan, J. P., National Inst. of Health, USA; Dec. 31, 1998; 8p; In English; BIOS 1998: Biomedical optics
Report No.(s): DE98-003495; LA-UR-98-284; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Functional analysis of the humane genome, including the quantification of differential gene expression and the identification of polymorphic sites and disease genes, is an important element of the Human Genome Project. Current methods of analysis are mainly gel-based assays that are not well-suited to rapid genome-scale analyses. to analyze Deoxyribonucleic Acid (DNA) sequence on a large scale, robust and high throughput assays are needed. The authors are developing a suite of microsphere-based approaches employing fluorescence detection to screen and analyze genomic sequence. The approaches include competitive DNA hybridization to measure DNA or Ribonucleic Acids (RNA) targets in unknown samples, and oligo ligation or extension assays to analyze single-nucleotide polymorphisms. Apart from the advances of sensitivity, simplicity, and low sample consumption, these flow cytometric approaches have the potential for high throughput multiplexed analysis using multicolored microspheres and automated sample handling.
NTIS
Deoxyribonucleic Acid; Cytometry; Polymorphism

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AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

19990025374 Texas Univ., Anderson Cancer Center, Houston, TX USA
Role of Dendritic Cells in Immune Dysfunction ***Final Report***
Savary, Cherylyn A., Texas Univ., USA; Jun. 30, 1998; 8p; In English
Contract(s)/Grant(s): NCC9-36; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The specific aims of the project were: (1) Application of the NASA bioreactor to enhance cytokine-regulated proliferation and maturation of dendritic cells (DC). (2) Compare the frequency and function of DC in normal donors and immunocompromised cancer patients. (3) Analyze the effectiveness of cytokine therapy and DC-assisted immunotherapy (using bioreactor-expanded DC) in a murine model of experimental fungal disease. Our investigations have provided new insight into DC immunobiology and have led to the development of methodology to evaluate DC in blood of normal donors and patients. Information gained from these studies has broadened our understanding of possible mechanisms involved in the immune dysfunction of space travelers

and earth-bound cancer patients, and could contribute to the design of novel therapies to restore/preserve immunity in these individuals. Several new avenues of investigation were also revealed. The results of studies completed during Round 2 are summarized.
Derived from text
Bioreactors; Therapy; Immune Systems; Immunology; Microbiology

19990025385 Naval Health Research Center, San Diego, CA USA
Effects of Repeated Doses of Caffeine during 64 Hours of Sleep Deprivation on Subsequent Recovery Sleep ***Final Report, Jun. 96***
Kelly, Tamsin; Gomez, S.; Ryman, D.; McGeoy, S.; Rubin, R.; Dec. 1998; 18p; In English
Report No.(s): AD-A359343; NHRC-96-11; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Both military operations and civilian emergencies may require sustained work, entailing prolonged periods with little or no sleep. Under these conditions, stimulants, most commonly caffeine, often are used to try to maintain alertness. However, stimulants can interfere with subsequent sleep, decreasing sleep's recuperative effects on alertness and performance. Caffeine has been well documented to impair sleep, generally causing increases in sleep latency and wake time, with reductions in the deeper sleep stages. Situations where less than a full-night's sleep occurs prior to returning to work would make such sleep impairment particularly problematic. The purpose of this study was to evaluate the effects of caffeine, administered in repeated doses during 64 hr of sleep deprivation, on alertness and performance during sleep deprivation and, in a subset of subjects, on subsequent nighttime recovery sleep. The focus of this report is caffeine effects on recovery sleep; effects on performance have been reported elsewhere. Nocturnal polysomnography was performed before and after 64 hr without sleep.
Author (DTIC)
Sleep Deprivation; Caffeine; Alertness; Military Operations

19990025457 NASA Langley Research Center, Hampton, VA USA
Aerospace Medicine and Biology: A Continuing Bibliography with Indexes, Supplement 487
Mar. 22, 1999; 27p; In English
Report No.(s): NASA/SP-1999-7011/SUPPL487; NAS 1.21:7011/SUPPL487; No Copyright; Avail: CASI; A03, Hardcopy; A01, 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. Two indexes-subject and author are included after the abstract section.
CASI
Bibliographies; Aerospace Medicine; Bioastronautics; Biological Effects; Exobiology; Indexes (Documentation)

19990025468 NASA Johnson Space Center, Houston, TX USA
Multidimensional Flow-Cytometric Analysis of Dendritic Cells in Peripheral Blood of Normal Donors and Cancer Patients
Savary, Cherylyn A., Texas Univ., USA; Grazziutti, Monica L., Texas Univ., USA; Melichar, Bohuslav, Texas Univ., USA; Przepiorka, Donna, Texas Univ., USA; Freedman, Ralph S., Texas Univ., USA; Cowart, Richard E., Texas Univ., USA; Cohen, David M., Texas Univ., USA; Anaissie, Elias J., Texas Univ., USA; Woodside, Darren G., Texas Univ., USA; McIntyre, Bradley W., Texas Univ., USA; Pierson, Duane L., NASA Johnson Space Center, USA; Pellis, Neal R., NASA Johnson Space Center, USA; Rex, John H., Texas Univ., USA; Cancer Immunol Immunother; 1998; Volume 45, pp. 234-240; In English
Contract(s)/Grant(s): NCC9-36; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We studied the potential of multidimensional flow cytometry to evaluate the frequency and maturation/activation status of dendritic cells in minimally manipulated peripheral blood mononuclear cell preparations (i.e., only separated on Ficoll-Hypaque) of normal donors and cancer patients. A rare subset of HLA-DR(+) leukocytes less than 1% mononuclear cells) was detected in blood of normal donors that displayed all the features of dendritic cells: these cells had high forward-light-scatter characteristics

and coexpressed CD4, CD86 and CD54 surface antigens, but lacked the lineage-associated surface markers of T cells, B cells, monocytes, granulocytes or NK (i.e. they were CD(3-), CD(19-), CD(20-), CD(14-), CD(11b-), CD(16-), CD(56-)).
Author
Cytometry; Blood; Cancer; Biological Effects; Leukocytes

19990025563 National Aeromedical Center, Soesterberg, Netherlands
Feedback of Anti-G Straining Performance of Pilots: The Use of the Late Ear Pulse Waveform as a Feedback Signal for Blood Pressure ***Final Report***
Holewijn, M., National Aeromedical Center, Netherlands; vandeEndt, M., National Aeromedical Center, Netherlands; Rijkelijkhuizen, J., National Aeromedical Center, Netherlands; Los, M., National Aeromedical Center, Netherlands; Jul. 1998; 23p; In English
Report No.(s): AD-A359055; 1998-K4; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

As a pan of a joint study of the National Aeromedical Institute (Soesterberg, the Netherlands), the National Aerospace Laboratory (Amsterdam, the Netherlands) and the Polish Air Force Institute of Aviation Medicine (Warsaw, Poland) an in-flight experiment was performed to evaluate the use of psycho-physiological measures as feedback parameters of physiological and mental strain. The main goal of this study was to evaluate the use of the ear pulse arterial waveform as a potential feedback parameter of a pilot blood pressure status during accelerations. The results of this study showed that the amplitude of the ear pulse waveform decreases with increasing acceleration during aerobatic profiles. The pulse transit time (PIT) of the ear pulse waveform increases with increasing acceleration during aerobatic profiles. These changes agree with the hypothesis that these changes reflect a decrease in blood pressure on head level during these profiles. Heart rates did not show a correlation with the acceleration levels during the investigated aerobatic profiles. It is discussed that this is the result from the response time of heart rate regulations, being not fast enough to follow the changes of the accelerations in the aerobatic profiles. The results of this study support the use of the amplitude and the PIT of the ear pulse waveform as an online feedback parameter of changes in blood pressure at head level, during exposure of a pilot to accelerations.
DTIC
Pulses; Heart Rate; Ear; Blood Pressure; Evaluation; In-Flight Monitoring; Stress (Psychology); Physiology

19990025601 Institute of Space Medico, Beijing, China
Changes of cerebral blood flow under lower body negative pressure
Hu, Zhihong, Institute of Space Medico, China; Zhao, Guoxuan, Institute of Space Medico, China; Yang, Jingsheng, Institute of Space Medico, China; Zhong, Chongfa, Institute of Space Medico, China; Chen, Xuemei, Institute of Space Medico, China; Space Medicine and Medical Engineering; October 1996; ISSN 1002-0837; Volume 9, No. 5, pp. 364-368; In Chinese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The cardiovascular effects and hemodynamics in the common carotid artery during supine lower body negative pressure (LBNP, 0, -2.7 kPa, -4.0 kPa, -5.3 kPa and -6.7 kpa) were studied in 11 young male volunteers with Color Doppler Ultrasound monitoring. The LBNP lasted for 5 min, 2 min, 3 min, 5 min, 10 min respectively. All the subjects except one finished the test. Changes of cardiac output(CO), blood pressure (BP)and calculated systemic vascular resistance(SVR) were measured. Changes of cerebral blood flow were estimated from changes of blood flow in the common carotid artery. Stroke volume and cardiac output decreased together with a small decrease in cerebral blood flow(CBF)when negative pressure increased, but the ratio between CBF and CO increased significantly.
Author
Blood Flow; Cerebrum; Blood Pressure; Cardiovascular System; Lower Body Negative Pressure

19990025602 Institute of Space Medico, Beijing, China
Effect of Hypoxia on pilot's cerebral oxygen saturation and blood volume
Yu, Yaorong, Institute of Space Medico, China; Bi, Kexu, Institute of Space Medico, China; Tian, Guangqing, Institute of Space Medico, China; Hu, Suwei, Institute of Space Medico, China; Shi, Xiuling, Institute of Space Medico, China; Zang, Yunning, Institute of Space Medico, China; Space Medicine and Medical Engineering; October 1996; ISSN 1002-0837; Volume 9, No. 5, pp. 360-363; In Chinese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Effects of hypoxia (10.5% V) on cerebral oxygen saturation (ScO2) and blood volume (BV)in the brain were studied in 60 pilots. A noninvasive and continuous near infrared instrument was used to monitor ScO2 and BV. Five pilots didn't complete the experiments, because their blood pressure (BP) and heart rate (HR) changed too large during the hypoxia. ScO2 of 80% normal subjects returned to control level in 8 min recovering time. But BV of all 60 subjects didn't return to control value in 10 min recovering period. The changes of ScO2 and BV of 5 subjects who didn't complete the experiments were significantly different from

those that of normal group during hypoxia (P less than 0.01). We believe that this near-infrared instrument is very useful for monitoring hypoxia.
Author
Hypoxia; Pilots (Personnel); Cerebrum; Blood Volume; Near Infrared Radiation; Anoxia; Oxygen Consumption

19990025615 Institute of Space Medico, Beijing, China
A study on improvement of tolerance to 21 d HDBR - 6 degree in young men by Qigong practice
Song, Kongzhi, Institute of Space Medico, China; Zhang, Jingxue, Institute of Space Medico, China; Xie, Junshui, Institute of Space Medico, China; Shan, Yi, Institute of Space Medico, China; Sun, Yongen, Institute of Space Medico, China; Space Medicine and Medical Engineering; October 1996; ISSN 1002-0837; Volume 9, No. 5, pp. 341-348; In Chinese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Weightlessness is simulated with - 6 deg head down bedrest (HDBR - 6 deg). 10 healthy male subjects aged 19-21 years served as subjects. 5 men undergone Qigong training were classified as Qigong group. The other 5 men without Qigong training served as the control. They all underwent HDBR - 6 deg for 21d. Qigong training are performed 3 times a day 50 min a time in Qigong group. Cardiac output (CO), heart rate (HR) electrocardiogram (ECG), body weight (BW), circumference of leg, pulse graph, H reflex , concentration of SOD, Ca(++) in blood, tolerance to orthostatic tilt were measured and Chinese medical examination was made. The results indicated that BW and circumference of leg in Qigong group decreased less as compared with the control. Subjective sensation and objective symptoms were less severe and CO decreased less as compared with the control. The total peripheral resistance of cardiovascular system decreased and the pulse pressure increased as compared with control group. The nervous transmission speed was higher and concentration of SOD and Ca(++) in blood was lower than that of the control group. It showed that Qigong practice increased the tolerance to simulated weightlessness in young men.
Author
Weightlessness Simulation; Bed Rest; Attitude (Inclination); Head Down Tilt; Physiological Effects; Weightlessness; Human Tolerances; Acceleration Tolerance; Orthostatic Tolerance

19990025616 Institute of Space Medico, Beijing, China
Comparison of effects of two Qigong methods on counteragent to simulated weightlessness
Xie, Junshui, Institute of Space Medico, China; Song, Kongzhi, Institute of Space Medico, China; Shan, Yi, Institute of Space Medico, China; Zhang, Jingxue, Institute of Space Medico, China; Space Medicine and Medical Engineering; October 1996; ISSN 1002-0837; Volume 9, No. 5, pp. 335-340; In Chinese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Healthy subjects were divided into three groups. The control group includes 10 male aged 19.8 +/- 1.4 years; Qigong group I includes 17 male aged 20.7 +/- 1.6 years; Qigong group II includes 50 male aged 22.5 +/- 1.9 years. The subjects in control group has not been trained, while subjects in Qigong I and Qigong II have been trained to practice Qigong but with different methods for one year. Head - down - tilt(- 30 deg) for 30 min was used as weightlessness simulation. Changes of strike volume(SV), lower limb blood flow(LBF), blood pressure, heart rate and temperature at Shanzhong, Laogong were measured and compared. The results clearly showed that both Qigong groups had improved counteragent against weightlessness stimulation and the method used by Qigong group II is more effective.
Author
Weightlessness Simulation; Blood Pressure; Head Down Tilt; Blood Flow; Heart Rate; Physiological Effects; Weightlessness

19990025617 Institute of Space Medico, Beijing, China
Spectral analyses of respiration and R - R interval under spontaneous respiration
Xu, Guolin, Institute of Space Medico, China; Peng, Yuankai, Institute of Space Medico, China; Zhang, Ruguo, Institute of Space Medico, China; Space Medicine and Medical Engineering; October 1996; ISSN 1002-0837; Volume 9, No. 5, pp. 330-334; In Chinese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A system with which ECG and respiratory signals sampled and analyzed synchronously was set up. It could recognize the respiratory wave(component of high frequency) in the R - R spectrum, and was used for the analysis of heart rate variability. The spectra of R - R interval and respiratory waves of 8 subjects during quiet sitting, quick calculation, exercise or inspiration of low concentration oxygen with spontaneous respiration were analyzed. The power of middle frequency / the power of high frequency(MF/HF), heart rate, and respiratory frequency increased significantly during quick calculation, as compared with those during quiet sitting. It indicates that MF/HF is sensitive to brain work. It was also demonstrated that when the same experimental data were analyzed with 0.15-0.5 Hz as high frequency band of the difference of nervous activities between quick calculation and

quiet sitting was not revealed. This suggested that it may be the respiratory wave and the middle frequency band in the R - R interval spectrum that reflect the changes of cardiovascular autonomic nervous activity.
Author
Spectrum Analysis; Respiration; Nervous System; Electrocardiography; Cardiovascular System

19990025619 Institute of Space Medico, Beijing, China
Mechanism of circulatory and respiratory failure caused by large amounts of air in the circulatory system
Jinfu, Yuan, Institute of Space Medico, China; Zhongyi, Ji, Institute of Space Medico, China; Yangsheng, Jin, Institute of Space Medico, China; Quan, Wang, Institute of Space Medico, China; Space Medicine and Medical Engineering; October 1996; ISSN 1002-0837; Volume 9, No. 5, pp. 324-328; In Chinese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

To confirm the hypothesis that the pathogenic mechanism of air infusion in the circulatory system is not bubble blockade of blood vessels but the consequence of anoxia of the vital organs, different amounts of air were injected into the great sapenous vein of 22 dogs, and then heart rate, cardiac rhythm and bubble sound were monitored with a Doppler probe at the precordial region. The result showed that in the 17 dogs that had received continued air infusion and maintained a degree - IV bubble sound, increase of respiration and heart rate and then arrhythmia, bradycardia, intensive abdominal breathing, weakness, dropping of tongue and failure to stand up were observed. Closed cardiac massage was performed immediately on 10 in the 12 animals that had continued slow air infusion till cessation of breathing, of which 8 recovered respiration and returned to normal; autopsy was performed in the other 2 that were not resuscitated and large amounts of air bubbles were found in the right atrium and ventricle, the venae cavae, and pulmonary vessels. This experiment suggested that large amounts of air had greatly changed the inner composition of the heart chamber and pulmonary vessel and thus caused ischemia and anoxia of myocardium and the respiratory and circulatory centers.
Author
Cardiovascular System; Respiration; Circulatory System; Heart Function; Dogs; Air; Bubbles; Aeroembolism; Decompression Sickness

19990025620 Institute of Space Medico, Beijing, China
Changes of endothelial cell count and morphology after inhalation of low oxygen gas mixture
Chen, Jianhe, Institute of Space Medico, China; Yu, Yaorong, Institute of Space Medico, China; Dong, Qi, Institute of Space Medico, China; Shen, Xianyun, Institute of Space Medico, China; Meng, Jingrui, Institute of Space Medico, China; Zang, Yunning, Institute of Space Medico, China; Space Medicine and Medical Engineering; October 1996; ISSN 1002-0837; Volume 9, No. 5, pp. 313-316; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The number and morphology of circulating endothelial cells(CEC) in 60 fighter pilots were observed before and after inhalation of low oxygen gas mixture. The results showed that the number of CEC increased from 1.03 +/- 0.48 (cell/microliter) to 3.73 +/- 0.57(cell/microliter) after inhalation of low oxygen gas mixture and the difference was statistically significant. It was also found that correlation exists between the degree of change and their daily habit. It is believed that the endothelial cells of blood vessels can be damaged by acute inhalation of low oxygen gas mixture which is responsible for the occupational disease of the pilots.
Author
Cells (Biology); Endothelium; Oxygen; Gas Mixtures; Respiration

19990025643 Hebrew Univ., Jerusalem, Israel
Annual Meeting of the European Neuroscience Association ***Annual Report***
Jan. 1996; 248p; In English; 18th, USA
Contract(s)/Grant(s): F61708-95-W-0431
Report No.(s): AD-A359005; EOARD-CSP-95-1045; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

The Final Proceedings for 18th Annual Meeting of the European Neuroscience Association, 3 September 1995 - 7 September 1995. RNA editing alters drug responses to AMPA receptors, Cis-trans regulation of Target genes for neurocognitive drugs, Endogeneous cacabinoid ligands in the central nervous system and in the periphery, Recimbinant acetylcholinesterase as a drug scavenger.
DTIC
Central Nervous System; Conferences; Ribonucleic Acids; Neurology; Drugs

19990025658 Texas Univ., Anderson Cancer Center, Houston, TX USA

In-Vitro Induced Immunosuppression in a Rotary Cell Culture System ***Final Report***

Grimm, Elizabeth A., Texas Univ., USA; Mar. 31, 1998; 2p; In English

Contract(s)/Grant(s): NCC9-36; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The function of the innate immune system is to provide a first-line of defense against infectious organisms, via control of bacterial and viral growth using antigen nonspecific means. These nonspecific immune effectors include macrophages and Natural Killing (NK) cells, and certain cytokines elicited in response to ”super antigens” on the infectious agents. This innate system usually keeps most infectious agents from rapidly growing while the adaptive immune system is generating a specific response complete with immunologic memory. Compelling evidence suggests that space flight results in various immunosuppressive effects, including reduced innate and adaptive immune responses. We were particularly concerned with reduced NK activity at landing, and have asked whether the microgravity component of space flight could be responsible for the previously observed NK defect. We have conclusively demonstrated that simulated microgravity as provided by the Synthecon bioreactors does not inhibit the NK function nor the IL-2 activation of lymphokine-activated killing (LAK). Interleukin-2 is the key cytokine responsible for activation of NK cells to express LAK, as well as to support differentiation of lymphocytes during adaptive immune responses. Therefore, we have disproved our original hypothesis based on poor NK in many of the astronauts upon landing.
Derived from text

Immune Systems; Immunity; Aerospace Medicine; Bioastronautics; Biological Effects; Microgravity; Antigens; Macrophages

19990025670 Advisory Group for Aerospace Research and Development, Aerospace Medical Panel, Neuilly-Sur-Seine, France

Aeromedical Support Issues in Contingency Operations ***Le Soutien Aeromedical Lors des Operations non Programmees***

September 1998; 420p; In English; In French, 29 Sep. - 1 Oct. 1997, Rotterdam, Netherlands; See also 19990025671 through 19990025721

Report No.(s): AGARD-CP-599; ISBN 92-836-0059-2; Copyright Waived; Avail: CASI; A18, Hardcopy; A04, Microfiche

These proceedings include the Technical Evaluation Report, two Keynote Addresses, 53 papers and the edited discussions of the Symposium sponsored by the North Atlantic Treaty Organization (NATO/RTO) Aerospace Medical Panel. It was held in Rotterdam, N-E from 29 September - 1 October 1997. Contingency Operations constitute military missions such as peacekeeping, humanitarian aid, peacemaking/enforcement, full scale offensive operations and relief operations other than war, such as aid to civil powers in counterterrorism and in natural disasters. Increasingly, these operations will involve greater NATO participation in the post ”Post-Cold-War” era. Significantly, NATO nations are turning to the application of science and technology, particularly computer resources, to address the unique problems associated with Contingency Operations. From a medical standpoint, there are many logistic, support and environmental factors which impede effective health and critical care medicine in Contingency Operations. This Symposium considered both the aeromedical problems encountered and the role of technological solutions as aids to resolving the issues in: (a) sustained and continuous operations, (b) medical management in remote locations, (c) medical information, and (d) adaptation to operational conditions. These proceedings will be of interest to heads of military health services, military and civilian officers concerned with the health and safety of personnel in air and support operations, research scientists, and those requiring a state-of-the-art review of medical ”lessons learned” in Contingency Operations.
Author

Conferences; Contingency; Medical Services; Operations Research; Research and Development; Human Factors Engineering; Medical Personnel; Telemedicine; Medical Equipment; Life Support Systems; Aerospace Medicine; Biological Effects; Aircraft Safety

19990025671 Royal Air Force, School of Aviation Medicine, Farnborough, UK

Sustained Air Operations: Prolonged Duty Overnight

Nicholson, A. N., Royal Air Force, UK; Stone, Barbara M., Defence Evaluation Research Agency, UK; Aeromedical Support Issues in Contingency Operations; September 1998; 14p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Sustained air operations imply round-the-clock scenarios and, inevitably, prolonged duty overnight. The ability of crews to cope with such work-rest patterns depends to a large extent on obtaining sufficient sleep during critical rest periods. Hypnotics may be essential to ensure sleep as the rest periods themselves are limited in number and duration, and occur at all times of the day and night. However, even if good sleep is attained during all the available rest periods, there may still be much difficulty in

sustaining alertness during duty overnight, particularly if the duty periods themselves are prolonged. This paper deals with the use of various potential interventions to sustain alertness during intensive air operations.
Author
Prolongation; Night; Alertness; Human Factors Engineering; Flight Crews; Aircraft Safety; Flight Safety; Aerospace Medicine; Biological Effects

19990025672 Armstrong Lab., Brooks AFB, TX USA
Aircrew Performance During Extended Simulated Bomber Missions
Whitmore, J., Armstrong Lab., USA; French, J., Armstrong Lab., USA; Armstrong, S., B-2 OT and E Team, USA; September 1998; 6p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Research was conducted to determine if fatigue impacted the performance of aircrew during long-duration bomber missions. Sustained flight in excess of 36 hours with only a minimal crew aboard was examined in two studies. Sixteen male USA Air Force B-1B bomber aircrew participated in the study. The participants served in crews of four and performed three 36-hour experimental periods (missions) in a high-fidelity B-1B simulator. The missions were interspersed with 36-hour rest breaks. Speech, cognitive, physiological (EEG, temperature), and subjective fatigue data were collected approximately every three hours for 11 trials per mission. A MANOVA analysis revealed a significant effect of trials for the aggregated measures (F(10,432) = 1.9885, p less than 0.0001). This result, along with trend analyses, indicated a strong diurnal pattern in nearly all of the dependent measures. End-mission performance was similar to beginning-mission performance. Crews were able to perform the missions successfully; however, several areas of increased risk due to fatigue were observed. Crew rest strategies prior to, during, and following a mission are discussed. A second study is described which evaluated three long-duration B-2 missions.
Author
Bomber Aircraft; Flight Crews; Pilot Performance; Flight Fatigue; Flight Safety; Aircraft Safety

19990025673 Paris V Univ., Lab. of Applied Anthropology, France
Rest Management and the Development of Signs of Fatigue in Pilots According to Work Shifts ***Gestion des Repos et Evolution des Manifestations de Fatigue chez les Pilotes selon les Rotations***
Mollard, R., Paris V Univ., France; Cabon, P., Paris V Univ., France; Mourey, F., Paris V Univ., France; Bougine, S., Paris V Univ., France; Coblentz, A., Paris V Univ., France; September 1998; 10p; In French; See also 19990025670; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Fatigue in airplane pilots constitutes one of the most often mentioned factors among reasons for reduced work performance. One of the available sources of information concerns the ASRS (Aviation Safety Reporting System), which allows American crews to report incidents confidentially. Analysis of these responses indicates that fatigue is explicitly mentioned in 4% of the events. Nevertheless, one can assume that fatigue is partially responsible for more than 20% of these incidents, given that other factors, such as inattention and communication problems, are often cited. Moreover, when pilots refer to fatigue, its associated causes prove to be quite diverse. Some pilots attribute it to lack of sleep, whereas for others long workdays or heavy workloads constitute the main causes for fatigue. One of the most frequently seen areas of confusion concerns the concept of sleepiness. Many studies conducted in real-life situations suggest that sleepiness and fatigue represent different ideas.
Author
Work-Rest Cycle; Aircraft Pilots; Rest; Aerospace Medicine; Biological Effects; Flight Fatigue

19990025674 Armstrong Lab., Combined Stress Branch, Wright-Patterson AFB, OH USA
Evasive Maneuvers and High-G Flight Safety After Sleep Deprivation
Chelette, T. L., Armstrong Lab., USA; Esken, R. L., Armstrong Lab., USA; Tripp, L. D., Armstrong Lab., USA; Albery, W. B., Armstrong Lab., USA; September 1998; 10p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

It is a common situation in the current global reach/global power mission to require fighter pilots to deploy overseas on short notice and to require immediate duty. Up to thirty six hours of sleeplessness is a common status in this environment. The objective of this study was to assess the performance of trained simulator pilots performing flight relevant tasks in the stressful environment of high G under two conditions; rested and 24 hours of sleeplessness. Performance was also compared to self-assessment and self reported effort and fatigue. Limited data was collected concerning a 2-4 week lay-off from the task. Volunteers (eight men & eight women) were trained to fly the Dynamic Environment simulator in a closed loop configuration air combat maneuvering up to 9 Gz. Before and after each session, their total body isometric strength was measured. During each sortie, thirty performance measures at simultaneous multiple tasks were measured. After each session, subjects completed a subjective questionnaire and a standardized subjective workload assessment. Neither male nor female overall performance was significantly affected by sleep status,

although individual tasks showed sensitivity; call-sign reaction time was longer by 33% and missile survival was considerably less likely. Also, perceived effort and physical demand were higher while perceived performance was lower when sleepless. Greater self reported effort on the anti-G straining maneuver correlated with better task performance and less post-G fatigue. Men are naturally stronger than women, however there was no significant decrease in strength due to G exposure in either the rested or sleepless conditions for either gender. Though sleep deprived pilots' subjective sensations may be that they are fatigued and unable to perform, objective measures show that their ability to conduct offensive maneuvers remains unchanged after 24 hours without sleep. However, when conversion to uncertain and spatially demanding defensive maneuvers occurs, survival may be compromised.
Author
Sleep Deprivation; High Gravity Environments; Evasive Actions; Aircraft Maneuvers; Flight Crews; Pilot Performance; Aerospace Medicine; Bioastronautics; Biological Effects; Aircraft Safety

19990025675 Netherlands Aerospace Medical Centre, Soesterberg, Netherlands
Pros and Cons of Strategic Napping on Long Haul Flights
Valk, P. J. L., Netherlands Aerospace Medical Centre, Netherlands; Simons, M., Netherlands Aerospace Medical Centre, Netherlands; September 1998; 6p; In English; See also 19990025670
Contract(s)/Grant(s): CAA-97.058; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Long haul operations involve rapid multiple time zone changes and long, irregular work schedules. These factors can result in sleep loss, circadian disruption, and fatigue with consequent effects on pilot's performance and alertness. A controlled nap in the cockpit is considered to be a useful countermeasure to inflight fatigue. Therefore, a study was conducted on the effects of a 40 minutes controlled rest period on the flight deck on crew performance and alertness. The alertness of the designated waking pilot, who has to remain alert while his colleague is resting, was explicitly assessed. Data was collected of 59 pilots, flying North-Atlantic B747-300 trips as scheduled in their regular duty roster. Pilots were equipped with a palmtop computer and an actigraph for objective and subjective assessment of quantity and quality of cockpit naps, alertness, and performance on a vigilance dual-task. During flights, measurements were performed before and after the rest period and before top of descent. It was found that a cockpit rest period improved alertness and performance of the rested pilots up to top of descent. Sleep during the rest period provided more improvement than rest alone. A number of designated waking pilots had difficulties in maintaining a sufficient level of alertness during the rest period of their colleague pilot. It is recommended to implement the use of preplanned controlled rest periods on the flight deck as a preventive fatigue countermeasure in 2- and 3-person flight deck operations. Measures to safeguard the alertness of designated waking pilots and guidelines to secure flight safety are discussed.
Author
Flight Safety; Aircraft Safety; Aerospace Medicine; Biological Effects; Flight Operations; Sleep Deprivation

19990025676 Netherlands Aerospace Medical Centre, Soesterberg, Netherlands
Early Starts: Effects on Sleep, Alertness and Vigilance
Simons, M., Netherlands Aerospace Medical Centre, Netherlands; Valk, P. J. L., Netherlands Aerospace Medical Centre, Netherlands; September 1998; 8p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Early starts and irregular work schedules might lead to disruption of sleep-wake rhythms with consequent sleep loss and fatigue. Fatigue is known to be a contributing factor to operational errors. The aim of this study was to determine the effects of early reporting times and irregular duty schedules on sleep, alertness and performance of pilots flying short-haul operations. Method: 6 Captains flying short-haul charters were measured during two 4-week periods. Subjects were equipped with a palmtop computer and an actigraph for subjective and objective measurement of sleep parameters, alertness, and performance on a vigilance dual-task. Each day subjects had to perform measurements before, during, and after flights and before and after the main sleep period. Results: It was found that pilots reporting before 06:00 a.m. had a significant shorter total sleep time, impaired sleep quality, and impaired performance both pre-flight and at top of descent. to a lesser degree, this also applied for reporting between 06:00 and 09:00 a.m. Degradation of sleep was most significant during the night prior to the start of a new duty period. Conclusion: Performance was primarily affected by inadequate sleep related to reporting times before 06:00 a.m. It is recommended that reporting times before 06:00 a.m. should be avoided, whenever possible. Pilots who have to report early, should try to anticipate insufficient sleep by advancing their sleep phase. This can only be achieved when early starts are planned on a regular basis. When irregular early starts are unavoidable, it should be considered to compensate for sleep reduction by planning sufficient time for recovery sleep.
Author
Sleep; Alertness; Wakefulness; Flight Fatigue; Aircraft Safety; Flight Safety; Aerospace Medicine; Biological Effects; Work-Rest Cycle

19990025677 Lyon-1 Univ., Dept. de Medecine Experimentale, Lyon, France

Neurobiological Basis of the Pharmacological Management of Sustained Alertness ***Bases Neurologiques de la Gestion Pharmacologique de l'Eveil***

Jouvet, Michel, Lyon-1 Univ., France; September 1998; 1p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A01, Hardcopy; A04, Microfiche; Abstract Only; Abstract Only

Since waking and sleep are regulated by two distinct systems, there are two different methods to increase the duration of waking, either by stimulating the waking systems or by inhibiting sleep-inducing mechanisms. Some advances in the understanding of the mechanisms of drugs acting upon the nervous system have been recently obtained by the development of immunohistochemistry of early genes. Among them, the immunohistochemistry of CFos protein is a good index of the neural systems which are activated after injection of drugs in animals. These data will be summarized together with the study of sleep which occurs after sustained wakefulness.

Derived from text

Nervous System; Wakefulness; Alertness; Pharmacology

19990025678 Army Aeromedical Research Lab., Fort Rucker, AL USA

The Efficacy of Dextroamphetamine for Sustaining Helicopter Pilot Performance: An In-Flight Evaluation

Caldwell, John A., Jr., Army Aeromedical Research Lab., USA; September 1998; 6p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The capability to operate 24 hours per day on the battlefield creates a tactical advantage over enemy forces. However, staffing shortages necessitating long work hours devoid of sleep eventually produce overwhelming fatigue, impairing performance and safety. In these situations, the only effective means to sustain performance may be the administration of stimulants. Unfortunately, studies of stimulants such as dextroamphetamine on the actual flight performance of aviators are virtually nonexistent. The present study assessed actual in-flight performance, mood, and alertness of UH-60 pilots during sleep-deprivation periods in which they were given either a 10-mg dose of Dexedrine or a placebo at 0000, 0400, and 0800 within the last 23 hours of each period. Results indicated better control (smaller RMS errors) of several flight parameters (i.e., heading, altitude, airspeed, etc.) under Dexedrine than placebo during straight-and-levels, climbs, descents, right turns, and a left-descending turn. Tendencies toward Dexedrine-related improvements also occurred in the left turns and the Instrument Landing System approach. The Profile of Mood States revealed reductions in fatigue, confusion, and depression concurrent with increases in vigor as a function of Dexedrine. Electroencephalographic data indicated enhanced central nervous system arousal under Dexedrine relative to placebo. No significant side effects occurred. It can be concluded that dextroamphetamine effectively sustained aviator performance during short-term sustained operations.

Author

Pilot Performance; Sleep Deprivation; Amphetamines; In-Flight Monitoring; Central Nervous System Stimulants

19990025679 Institut de Medicine Aerospatiale Armee, Bretigny sur Orge, France

Pharmacological Sleep Management: Interest of Modafinil ***Gestion Pharmacologique du Sommeil: Interet du Modafinil***

Lagarde, Didier, Institut de Medicine Aerospatiale Armee, France; September 1998; 8p; In French; See also 19990025670; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

During sustained and continuous operations the sleep-wakefulness cycle is often disturbed: jet-lag, shift lag, prolonged sleep deprivation. The vigilance management in operational conditions includes pharmacological and non-pharmacological countermeasures. Sometimes non-pharmacological countermeasures, i.e, preventive, ergonomic and physical measures become inefficient or are inapplicable, so in these cases, military research teams are looking for pharmacological measures. There is a great variety of substances which may be used to reduce the effects of these sleep disturbances. These substances have to take place in a straight rule which could be resumed in 4 points: 1) an easy ingestion; 2) a quick effect after treatment; 3) a modulating time duration effect, dose-function; and 4) without side effects. Generally, three kinds of substances could be used: 1) hypnotic substances to induce a recovery sleep; 2) wakening substances to maintain a good level of vigilance; 3) synchronizer to resynchronize biological rhythms after jet-lag. In this work, the author presents an interesting synthetic substance called Modafinil (MODIODAL(R)). This substance is a medicine used to treat narcolepsy and hypersomnia. But modafinil could also act in healthy subjects, for example during a long sleep deprivation, and maintain a good level of vigilance and performance during 60 hours of continuous wakefulness. A neuroprotector effect at high dose has been demonstrated. The action mechanism of modafinil is complex. Modafinil modulates (as agonist) central post-synaptic alpha 1 noradrenergic receptor (wakefulness effect). At high doses, it increases dopamine level in nucleus accumbens (locomotor effect). It has also an indirect participation in the serotoninergic system (wakefulness effect). It induces a decrease of cortisol liberation of the GABA (wakefulness effect), and induces moderate transient increase in aspartate and glutamate (wakefulness effect) followed by long lasting decrease of extra-cellular excitatory amino-acids

(neuroprotector effect). Modafinil increases a brain metabolic energetic compound: the phosphocreatine, and it induces an activation of proto oncogen c-fos in anterior hypothalamic nucleus. Modafinil (MODIODAL(R)) appears as an interesting substance in SUSOPS and CONOPS, easy to take, with a dose-effect to modulate the action. No major side effect was described. It is a wakening substance and not an anti-sleep drug. Modafinil could be a very useful substance during real sustained operations but we have to take care of the wrong use.
Author
Pharmacology; Sleep Deprivation; Drugs; Wakefulness; Central Nervous System Stimulants

19990025680 Centre de Recherches du Service de Sante des Armees, La Tronche, France
Modafinil Effects on Spatial Cognition During 60 Hours of Sleep Deprivation
Raphel, Christian, Centre de Recherches du Service de Sante des Armees, France; Esquivie, Dominique, Centre de Recherches du Service de Sante des Armees, France; Stivalet, Philippe, Centre de Recherches du Service de Sante des Armees, France; Cian, Corinne, Centre de Recherches du Service de Sante des Armees, France; Baranski, Joseph V., Defence and Civil Inst. of Environmental Medicine, Canada; Leifflen, Daniel, Centre de Recherches du Service de Sante des Armees, France; Poquin, Didier, Centre de Recherches du Service de Sante des Armees, France; Barraud, Pierre-Alain, Centre de Recherches du Service de Sante des Armees, France; September 1998; 4p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A01, Hardcopy; A04, Microfiche

Modafinil is currently being investigated in the context of sustained military operations as a potential countermeasure to the effects of extensive sleep deprivation (SD) on human cognitive performance. The aim of this present study is to analyze SD and dose-related effects of Modafinil on spatial cognition according to information processing patterns. Six normal healthy French military personnel participated for 4 one-week testing sessions involving double-blind, placebo-controlled manipulation of three doses of Modafinil (50, 150 and 300 mg/24hrs) during 60 hours of SD. Cognitive tasks investigated spatial abilities. Information processing data analysis indicates that Modafinil effectiveness is to be qualified based on the dose of Modafinil and psychological processes. Thus, Modafinil has more important beneficial effects on the serial processes which govern the speed of attentive spotlight scanning of the visual field, but a lower effect on the decision making processes involved in the same task. Regarding sensory interactions between vestibular system and vision, low doses (50 et 150 mg/24hrs) of Modafinil have beneficial effects, while a dose of 300 mg/24hrs produces effects which are similar to those observed with a placebo. Lastly, Modafinil have beneficial effects on mental imagery processes, however its effectiveness on mental image accuracy seems to be restricted to 48 hours of SD while vigilance is still well-preserved. This experiment suggest that sensorial integration processes, working memory and control operators are the preference target site for SD and Modafinil.
Author
Central Nervous System Stimulants; Information Processing (Biology); Mental Performance; Sleep Deprivation; Cognition; Performance Tests

19990025681 Naval Action Force, Toulon, France
Slow Release Caffeine: A Valid Pharmacological Countermeasure
Sicard, B., Naval Action Force, France; Lagarde, D., Centre d'Enseignement et de Recherches de Medecine Aeronautique, France; Batejat, D., Centre d'Enseignement et de Recherches de Medecine Aeronautique, France; Chauffard, F., Nestle Research Centre, Switzerland; Enslen, M., Nestle Research Centre, Switzerland; Tachon, P., Nestle Research Centre, Switzerland; September 1998; 4p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A01, Hardcopy; A04, Microfiche

Sleep deprivation and desynchronization due to night watch, continuous operations or jet lag induce sleepiness and a decrement in performances: studies have shown that caffeine can be an effective countermeasure in such circumstances. We evaluated a slow release caffeine (SRC), which delays the mean peak plasma concentration and lowers the plasmatic Cmax. Tolerance of 600 mg SRC was assessed in a double-blind, placebo controlled, parallel-group study, involving 120 young adult males. This single dose of SRC was well tolerated by these rested subjects. Pharmacokinetic parameters were not influenced by acetylator status or caffeine use; however calmness and sleep onset were disturbed. Then in another experiment we evaluated in four sessions, 150, 300, 600 mg SRC and a placebo in 24 sleep deprived male and female subjects. Alertness and psychomotor performance were enhanced in both sex. The higher sensitivity to caffeine doses observed in the female group was related to greater susceptibility to sleep deprivation, and to increased salivary caffeine levels correlated with inferior body weight and use of oral contraceptives. Therefore the use of 300 mg SRC by fatigued subjects may significantly improve alertness and performance, with a wider acceptance and tolerance than other psychostimulants like dextroamphetamine.
Author
Caffeine; Psychomotor Performance; Pharmacology; Countermeasures; Performance Tests; Wakefulness

19990025682 Centre d'Enseignement et de Recherches de Medecine Aeronautique, IMASSA, Bretigny, France

Cognitive Performance During a 64-Hours Sleep Deprivation: Interest of a Slow Release Caffeine ***Performances Cognitives de Sujets Soumis a une Privation de Sommeil Totale de 64 Heures: Interet d'une Forme a Liberation Prolongee de Cafeine***

Doireau, P., Centre d'Enseignement et de Recherches de Medecine Aeronautique, France; Batejat, D., Centre d'Enseignement et de Recherches de Medecine Aeronautique, France; Chauffard, F., Nestle Research Centre, Switzerland; Enslen, M., Nestle Research Centre, Switzerland; Tachon, P., Nestle Research Centre, Switzerland; Pradella, S., Centre d'Enseignement et de Recherches de Medecine Aeronautique, France; Lagarde, D., Centre d'Enseignement et de Recherches de Medecine Aeronautique, France; September 1998; 12p; In French; See also 19990025670; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Sleep deprivation is a consequence of modern military warfare. It leads to mental and physical performance decrement. Historically, psychostimulants have been widely used in the military context. Among them, caffeine is the most commonly taken, thus not prescribed, substance to cope with fatigue. Caffeine increases the level of alertness and the cognitive performance of fatigued personnel. Nevertheless, this effect is transitory and leads to chronic consumption and well known side effects. Recently, a slow release (SR) caffeine has been designed by NESTEC to improve its usability in sleep deprivation context. We present some data of an experiment conducted to answer the two following questions: 1) is SR caffeine an effective substance to maintain a good level of alertness during a 64-hours sleep deprivation?; and 2) is it able to alleviate the performance decrement of subjects? We will focus here on the results of the last objective.

Author

Caffeine; Alertness; Mental Performance; Sleep Deprivation; Performance Tests; Cognition

19990025685 Universidad Complutense, Dept. of Physiology, Madrid, Spain

Urinary Melatonin Excretion in Airline Pilots Submitted to Transmeridian Flights

Tresguerres, J., Universidad Complutense, Spain; Ariznavarreta, C., Universidad Complutense, Spain; Granados, B., Universidad Complutense, Spain; Martin, M., Universidad Complutense, Spain; Villanua, M. A., Universidad Complutense, Spain; Golombek, D., Universidad Complutense, Spain; Cardinali, D. P., Buenos Aires Univ., Argentina; September 1998; 4p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A01, Hardcopy; A04, Microfiche

Endogenous biological circadian rhythms are present in the majority of behavioural and physiological variables of all living organisms. These rhythms are entrained to the external environment in which they live, and get desynchronized as a consequence of transmeridian flights. This study has investigated changes occurring in various biological markers in air line pilots during and after westbound (Madrid-Mexico) and eastbound (Madrid-Tokyo) flights. The results have been compared to those of a non flying control group over a 6 day period. A clear cut activity rhythm adapted to the local "Zeitgeber" was present over the whole period in controls as well as an evident rhythm in the urinary excretion of 6 sulfatoxy melatonin. Pilots showed alterations of the melatonin rhythm already on the day before of the flight, probably due to the desynchronizing effects of previous transmeridian flights. to Mexico, the rhythm remained adapted to Madrid in the first day and started to get adjusted to local time the second day. Pilots older than 50 years showed a higher resistance to change their excretory rhythm, to adjust to the local environment. The return flight to Madrid occurred in the middle of maximal 6 sulfatoxy melatonin excretion. Experimental subjects flying to Tokyo showed a complete disruption of the hormonal excretory, and of the activity rhythms. All subjects showed tiredness and anxiety at the end of the flights, being at a maximum when arriving to Tokyo. Pilots did not completely recover before the return flight.

Author

Aircraft Pilots; Hormones; Circadian Rhythms; Jet Lag; Desynchronization (Biology); Flight Stress (Biology); Human Performance; Physiological Effects

19990025686 Army Aeromedical Research Lab., Fort Rucker, AL USA

Aviator's Grounding Time After Melatonin Administration During Rapid Deployment Missions

Comperatore, Carlos A., Army Aeromedical Research Lab., USA; Wright, Darlene, Army Aeromedical Research Lab., USA; Day-Clayton, Melanie, Army Aeromedical Research Lab., USA; Riuvera, Pik, Army Aeromedical Research Lab., USA; Bey-Wright, Regina, Army Aeromedical Research Lab., USA; Kirby, Albert W., Universal Energy Systems, Inc., USA; September 1998; 10p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The determination of drug-induced grounding time for aviation personnel can be derived from the drug's half-life, the assessment of hangover effects, and the evidence that sleep, alertness, and cognitive functions are normal some time after administration. Melatonin's half-life has been reported at approximately 60 minutes. Its side effects, particularly in the case of low doses no greater than 1 mg, generally are limited to drowsiness during the first 2 h after administration. This would imply that grounding time would be minimal for regimens employing l mg or less. However, the use of melatonin in rapid military deployments depends upon the

development of regimens which can induce large advances or delays of circadian rhythms in relatively short periods of time (1-2 days).
Derived from text
Circadian Rhythms; Hormones; Aircraft Pilots; Pilot Performance; Half Life

19990025687 Force d'Action Navale, Toulon, France
Zolpidem, Sleepiness and the Psychomotor Capacities of Ground Personnel and Pilots ***Zolpidem, Vigilance et Capacites Psychomotrices de Personnels au Sol et de Pilotes***
Sicard, B., Force d'Action Navale, France; September 1998; 6p; In French; See also 19990025670; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

During extended operations, crews often suffer from fatigue linked to rest periods that are quantitatively or qualitatively insufficient. These episodes of sleep deprivation are caused by many factors: workload, desynchronization during deployments across several time zones or during repeated night missions (or flying the latter exclusively), inadequate environmental sleep conditions (noise, extreme temperatures), excitability due to operations and combat stress. The use of soporifics is one of several means for optimizing crew rest periods. The ideal soporific for this purpose should be able to induce rapidly a period of sleep that is equal in quality to approximately 5 hours of physiological sleep and has no residual effects upon awakening, even for complex tasks such as pilotage.
Derived from text
Sleep Deprivation; Psychomotor Performance; Pilots; Ground Crews; Workloads (Psychophysiology); Sleep

19990025688 Royal Air Force, Personnel and Training Command, Gloucester, UK
Operational Determinants of Medical Planning
Gibson, T. M., Royal Air Force, UK; September 1998; 6p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Aeromedical evacuation is but one stage of medical treatment for surviving casualties of a military operation. Planning for aeromedical evacuation must take account of the overall medical estimate. This paper describes the factors that medical staffs have to take into account during the planning stage of military operation and draws attention to some of the lessons learned from recent operations.
Derived from text
Medical Services; Aerospace Medicine; Operational Problems; Evacuating (Transportation); Casualties

19990025689 Air Force Medical Center, 59th Medical Wing, Lackland AFB, TX USA
Casualty Care for 2010 and Beyond
Hersack, Richard A., Air Force Medical Center, USA; Carlton, Paul K., Jr., Air Force Medical Center, USA; Farmer, Chris, Air Force Medical Center, USA; September 1998; 24p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper discusses the priorities from medical readiness which include: (1) provide "essential" care forward, i.e. switch from "definitive" care forward with emphasis on casualty prevention; (2) critical care capable evacuation system; (3) modularize deployable medical units.
Derived from text
Casualties; Prevention; Health

19990025690 Air Force Medical Center, 59th Medical Wing, Lackland AFB, TX USA
Experiences of the Critical Care Air Transport Teams (CCATT) During Operation Joint Endeavor
Hersack, Rick, Air Force Medical Center, USA; Lawlor, Dennis, Air Force Medical Center, USA; Carlton, P. K., Jr., Air Force Medical Center, USA; Beninati, William, Air Force Medical Center, USA; Grissom, Thomas, Air Force Medical Center, USA; Morales, Carlos, Air Force Medical Center, USA; Derdak, Stephen, Air Force Medical Center, USA; Farmer, J. Christopher, Air Force Medical Center, USA; September 1998; 4p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A01, Hardcopy; A04, Microfiche

For the past year, Critical Care Air Transport Teams (CCATT's) from Keesler Medical Center, Keesler AFB, Mississippi and Wilford Hall Medical Center, Lackland AFB, Texas have been deployed to support Operation JOINT ENDEAVOUR (OJE), the NATO peace effort in Bosnia. This is the largest operation involving the use of the CCATT's to date. A CCATT consists of a physician specializing in intensive care medicine, a critical care nurse, and a cardiopulmonary technician. The CCATT uses transport monitors, ventilators, portable blood analyzers and other medical equipment commonly used in our medical centers' intensive

care units. The CCATT augments the standard aeromedical evacuation aircrew so that critically ill or injured patients may be evacuated from forward areas to definitive care hospitals. Otherwise, field hospitals in forward areas would have to provide care for these patients until they were stable enough to travel unaccompanied, creating huge logistical demands, or provide a physician to accompany the patient during evacuation, leaving forward field hospitals understaffed. Providing increased clinical capabilities aboard patient evacuation flights is not new. Several other nations' military medical services have extensive experience using enroute care providers to manage critically ill or injured patients during evacuation. During one year of the OJE deployment, the CCATT's moved 44 patients in 42 missions. Of these patients, 22 required mechanical ventilation during the flight. Eight missions were transatlantic flights to return patients to treatment facilities in the USA. CCATT's also redeployed to support the evacuation of foreign nationals from Liberia and rescue operations after the Khobar Towers Bombing in Dhahran. With the end of the "Cold War", a shift in military medical planning now calls for a reduced medical presence in areas of conflict and a subsequent increased reliance on patient movements out of theater for definitive medical and surgical care. The CCATT concept is an effective solution that fills the need for long range critical care air evacuation and easily integrates into the current aeromedical evacuation system.
Derived from text
Air Transportation; Patients; Medical Services; Military Operations; Rescue Operations

19990025691 Aeromedical Evacuation Squadron (0043rd), Pope AFB, NC USA
Evolving Doctrine in the Theater Aeromedical Evacuation System (TAES): Operation JOINT ENDEAVOR/GUARD and Beyond
Miller, P. M., Aeromedical Evacuation Squadron (0043rd), USA; September 1998; 4p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A01, Hardcopy; A04, Microfiche

With an increase in contingency operations in the NATO theater of operations, the Theater Aeromedical Evacuation System (TAES) needs to be flexible to meet the ever-changing demands of both combat operations and military operations other than war. Recent evolution in USA medical evacuation policies have made it necessary for the TAES to also change the way it does business. This paper discusses the composition of the TAES, recent additions to the TAES, trends in US medical policies, and implementation of the TAES during Operation JOINT ENDEAVOR/GUARD.
Derived from text
Medical Services; Evacuating (Transportation); Military Operations; Air Transportation

19990025692 Air Force Medical Center, 59th Medical Wing, Lackland AFB, TX USA
The Mobile Field Surgical Team (MFST): A Surgical Team for Combat Casualty Care in the Information Age
Carlton, P. K., Air Force Medical Center, USA; Pilcher, John, Air Force Medical Center, USA; September 1998; 4p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A01, Hardcopy; A04, Microfiche

The current military medical system is designed to support 20th century combat: the forces involved in the conflict were large, powerful, and ponderous. Medical planning for conflicts such as these included several assumptions about the conditions involved (1) Discrete build-up phase - medical units would have time to assemble their assigned personnel and materials, and would be permitted to set up these facilities before use of the facilities would be required; (2) Large number of casualties; (3) Definitive care in theater - lines of battle were fairly stable; thus injured personnel would be treated in-theater until they reached a convalescent phase. At that point they would be returned to duty or evacuated from the theater; and (4) Traditional evacuation system - the Air Evacuation system would serve to transport patients who had been injured, but had essentially no ongoing requirements for medical care. The assets that were developed to meet the medical needs of these conflicts (the Air Transportable Hospital (ATH), Combat Support Hospital (CSH), and Fleet Hospital) are very capable and offer a variety of medically oriented services. They are essentially full-service hospitals packaged in a format that can be moved by air or sea. As full-service hospitals, they are quite large and heavy, and they require a significant amount of time and space to set up. The ATH (for example) is intended to be deployed in a modular or "building block" fashion, but this is implemented by bringing primary care capability into the theater first. Thus a full 50-bed ATH is necessary before trauma surgery or even an appendectomy can be performed. This set of equipment is packaged on 52 pallets, requiring airlift of seven C-141 aircraft.
Derived from text
Surgery; Support Systems; Air Transportation; Casualties; Deployment

19990025693 Air Force Medical Center, 59th Medical Wing, Lackland AFB, TX USA
The Provision of Intensive Care Medicine in Austere Field Locations
Farmer, J. Christopher, Air Force Medical Center, USA; Carlton, P. K., Jr., Air Force Medical Center, USA; Kilpatrick, Russell, Air Force Medical Center, USA; Derdak, Steven, Air Force Medical Center, USA; Hersack, Richard, Air Force Medical Center, USA; Morales, Carlos, Air Force Medical Center, USA; King, Jim, Air Force Medical Center, USA; Ramon, Jose, Air Force Medi-

cal Center, USA; Beninati, Bill, Air Force Medical Center, USA; Grissom, Thomas, Air Force Medical Center, USA; Lawlor, Dennis, Air Force Medical Center, USA; Guz, Evan, Air Force Medical Center, USA; Biggers, Butch, Air Force Medical Center, USA; September 1998; 5p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A01, Hardcopy; A04, Microfiche

Technologic advances have made laboratory testing feasible at the bedside. Point-of-care testing (POCT) allows medical providers to assess a wide range of clinical conditions in a rapid fashion at the site of patient interaction. While POCT has begun to impact on the delivery of care in the hospital setting, its potential for use in remote, field environments or during aeromedical evacuation is just being realized. In the civilian setting, discussion of POCT focuses on regulatory guidance, cost effectiveness, and reimbursement. Little attention has been paid in the literature to expanding the use of these capabilities beyond the traditional hospital boundaries. In this paper, we will briefly review the development of POCT and the associated technology. In addition, we will discuss the potential role of POCT in the field using current technology. Finally, we will review the available literature on use of POCT in the field.

Derived from text

Evacuating (Transportation); Medical Services; Cost Effectiveness; Air Transportation

19990025694 School of Aerospace Medicine, Brooks AFB, TX USA

Point-of-Care Testing: Can it be Adapted for the Field Environment?

Grissom, Thomas E., School of Aerospace Medicine, USA; Lawlor, Dennis, Air Force Medical Center, USA; September 1998; 6p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Technological advances have made laboratory testing feasible at the bedside. Point-of-care testing (POCT) allows medical providers to assess a wide range of clinical conditions in a rapid fashion at the site of patient interaction. While POCT has begun to impact on the delivery of care in the hospital setting, its potential for use in remote, field environments or during aeromedical evacuation is just being realized. In the civilian setting, discussion of POCT focuses on regulatory guidance, cost effectiveness, and reimbursement. Little attention has been paid in the literature to expanding the use of these capabilities beyond the traditional hospital boundaries. In this paper, we will briefly review the development of POCT and the associated technology. In addition, we will discuss the potential role of POCT in the field using current technology. Finally, we will review the available literature on use of POCT in the field.

Author

Medical Services; Field Tests; Medical Equipment

19990025695 Air Force Medical Center, 59th Medical Wing, Lackland AFB, TX USA

Use of Point of Care (POC) Laboratory Devices by Critical Care Air Transport Teams (CCATT) of the USA Air Force

Lawlor, Dennis, Air Force Medical Center, USA; Grissom, Thomas, School of Aerospace Medicine, USA; September 1998; 4p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A01, Hardcopy; A04, Microfiche

Point of Care (POC) laboratory devices have recently been utilized in medical centers to provide rapid results at the bedside of critically ill patients. The locations most commonly targeted are the Intensive Care Unit, the Operating Room, the Recovery Room and the Emergency Room. The impetus to use these devices is to provide immediate, accurate results of several critical laboratory values, especially those values that can change quickly. Instruments that can measure pCO2, pO2, pH, hemoglobin, hematocrit, sodium, potassium, chloride, glucose, urea, and ionized calcium and provide results in several minutes are already available. Technological requirements for a POC device include being small (less than 10 pounds), use small quantities of blood, can use AC or DC current, and require a minimum of effort to calibrate.

Derived from text

Air Transportation; Potassium Chlorides; Sodium Chlorides; Emergencies; Patients; Hemoglobin; Glucose; Hematocrit

19990025696 Walter Reed Army Inst. of Research, Div. of Surgery, Washington, DC USA

Life Support for Trauma and Transport (LSTAT(trademark)): A NATO Litter-Based Critical Care Transport Platform

Pearce, F. J., Walter Reed Army Inst. of Research, USA; Wiesmann, W. P., Army Medical Research and Materiel Command, USA; Hale, J., Armstrong Lab., USA; Licina, J. R., Army Aeromedical Research Lab., USA; September 1998; 4p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A01, Hardcopy; A04, Microfiche

A significant portion of the military field medical footprint is currently consumed by post surgical patients, which according to current doctrine, must be stable before evacuation. This requirement results in a significant logistical burden for our ground forces. At present, we do not have adequate monitoring or therapeutic capabilities during ground or air transport to a definitive care treatment facility. In response to this need, we initiated a research and development activity to design and build a NATO-stretcher-based mini-intensive care unit that incorporates resuscitative and life-sustaining capabilities for field surgery and en route care. The LSTAT(trademark) has 3 basic components: (i) the base unit; (ii) a NATO stretcher; and (iii) a canopy that covers

the entire patient. The LSTAT(trademark) base contains medical, diagnostic and therapeutic components while medical parameters, system performance data and user interactions are continuously monitored and logged by an on-board CPU. Provision is made for storage of up to 36 hours of physiologic and system performance data which can be uploaded to a local or remote host computer. When necessary, this data can also be communicated to the receiving hospital during evacuation for review by physicians to aid in their medical preparations for treatment. This facility provides a new life support capability for transport of marginally stable or unstable patients which integrates with existing NATO evacuation platforms.
Derived from text
Life Support Systems; Air Transportation; Physiology; Diagnosis; Surgery

19990025697 Defence and Civil Inst. of Environmental Medicine, Operational Human Engineering Group, North York, Ontario Canada
An Integrated Medical Monitor for Aeromedical Use
Dyck, W. R., Defence and Civil Inst. of Environmental Medicine, Canada; Nichols, A., CME Telemetrix, Inc., Canada; September 1998; 8p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

As early as 1973, the Canadian Forces Medical System realized that medical monitoring of a casualty in the field, in the presence of an NBC threat, is very difficult. More recently, during the Gulf War, this deficiency was again addressed. A Canadian Forces (CF) requirement was written for a portable, integrated system for monitoring the vital signs of patients in the field, under adverse, unconventional conditions. Design considerations of such a device included that it be rugged, battery operated, easy to use, and yet be accurate enough to be useful as a monitoring tool. A project began, within the Canadian research and development branch, to identify existing technologies, to perform a feasibility study of developing the technology internally, and then to develop a vital signs monitor, if economical to do so. A CF version of a vital signs monitor was developed, and the technology was transferred to industry. The device, VITSEM 200 produced by CME Telemetrix, is described, and available for demonstration. The VITSEM 200 can be used to monitor heart rate, body temperature, and blood oximetry continuously, and blood pressure when required. It measures 14.7 x 9.3 x 5.4 cm and weighs approximately 390 g. A version of the device (less the blood oximetry capability) has been evaluated successfully in a simulated NBC environment, and in a helicopter - deemed to be two of the most demanding adverse scenarios. The VITSEM 200 is currently being acquired by the Department of National Defence in sufficient quantities for user evaluations. If the user evaluations are successful, it is anticipated that the VITSEM 200 will become a new and valuable tool within all the medical elements of the CF.
Derived from text
Aerospace Medicine; Casualties; Oximetry; Patients; Warfare

19990025698 Department of the Air Force, Nurse Corps, Brooks AFB, TX USA
Spinal Cord Injury Transport System
Mason, Barbara-Marie, Department of the Air Force, USA; September 1998; 2p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A01, Hardcopy; A04, Microfiche

The USA Air Force Air Mobility Command (AMC) is tasked to provide the aeromedical evacuation of casualties in routine and contingency operations. to carry out this mission, AMC needs a medical support system suitable for transporting patients with spinal cord injuries and all types of extremity and cervical traction requirements. This piece of equipment would be a Spinal Cord Injury Transport System (SCITS). The current method for transporting these patients is on the Stryker Turning Frame with a Collins Traction Device, for cervical traction. The system has been in use for over 20 years and is no longer logistically supported and must be replaced. The replacement system should provide a quality of care comparable to that available in fixed (ground) medical treatment facilities; i.e., a system that provides traction and kinetic therapy through incremental side-to-side rotation. Although SCITS will primarily be used for the previously mentioned patients, it would be beneficial and used for a variety of other patient conditions such as multiple trauma, burns, chest wounds, pulmonary complications, and post operative, depending on availability.
Derived from text
Spinal Cord; Injuries; Air Transportation; Evacuating (Transportation); Medical Services; Support Systems; Casualties

19990025699 Department of the Air Force, Nurse Corps, Brooks AFB, TX USA
Advanced Hybrid Oxygen System-Medical
Mason, Barbara-Marie, Department of the Air Force, USA; September 1998; 2p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A01, Hardcopy; A04, Microfiche

In 1993, a human system need request was submitted by Air Mobility Command to the Human Systems Center Plans and Program Office. This document tasked the aeromedical systems division to determine the feasibility of a hybrid oxygen system

that could support the flight crew, patients and passengers on board an aircraft. What is currently available for flight crew is a variety of oxygen systems. There are liquid oxygen (LOX) systems, gaseous oxygen and onboard oxygen generating systems. The Patient Therapeutic LOX system is currently used for the patient therapeutic oxygen and passenger supplemental oxygen onboard some aeromedical evacuation aircraft. The limitations of existing onboard oxygen generating systems are they are not capable of generating or storing sufficient oxygen to meet patient and passenger needs.
Derived from text
Aerospace Medicine; Oxygen Supply Equipment; Liquid Oxygen; Air Transportation; Evacuating (Transportation); Flight Crews; Medical Services

19990025700 School of Aerospace Medicine, Brooks AFB, TX USA
Mechanical Ventilator Performance During Aeromedical Evacuation
Grissom, Thomas E., School of Aerospace Medicine, USA; Papier, Kenneth S., Air Force Medical Center, USA; Lawlor, Dennis, Air Force Medical Center, USA; Farmer, J. Christopher, Air Force Medical Center, USA; Derdak, Stephen, Air Force Medical Center, USA; September 1998; 8p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Current USA military medical planning calls for a decreased medical presence in areas of conflict with increased reliance on patient movements out of theater for more definitive medical and surgical care. As a result, the aeromedical evacuation system will be moving patients with critical conditions and injuries faster and further than during past contingencies. This will include the movement of an increasing number of patients requiring mechanical ventilatory support. Advances in ventilator technology have led to the introduction of smaller and more capable transport ventilators. Some of these ventilators use built in air compression devices which remove the necessity of carrying an external compressor. In addition, manufacturers have incorporated newer modes of ventilation to improve patient tolerance of mechanical ventilation and provide the user with route care capability for the critically injured or ill patient.
Derived from text
Ventilators; Oxygen Consumption; Military Operations; Evacuating (Transportation); Air Transportation; Medical Services

19990025701 Militair Hospitaal Dr. A. Mathijsen, Utrecht, Netherlands
The Use of Ultrasound in Military Traumatology
vanDalen, Albert, Militair Hospitaal Dr. A. Mathijsen, Netherlands; September 1998; 6p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

In the last decade ultrasound (US) has become a very important diagnostic tool in many areas of medicine, including traumatology. US is a reliable method to detect blood in the peritoneum. When a modem system and a skilled examiner are available the invasive diagnostic abdominal tap has become obsolete. Also hematothorax and hemopericard are easily diagnosed with US and diagnostic or evacuating puncture can safely be performed under US guidance. US can also evaluate organ damage, in particular of pheripheral anatomical structures. It may guide interventional procedures and is very helpfull in the detection of foreign bodies, not visible on conventional radiographs. For these reasons 21 portable US systems were purchased by the Netherlands armed forces in 1993, intended for use- next to X-ray equipment - in field hospitals with operating room facilities. Practical experience with the US systems was obtained during two years of ”peacekeeping” activities in former Yugoslavia. Due to modern technology a further reduction in size with development of one hand hold systems with good imaging qualities will soon be realised. This allows US examination of injured patients on the battlefields. In case of many victims and limited capacities US may play an important role in triage.
Derived from text
Radiography; Imaging Techniques; Peritoneum; Blood; Ultrasonics

19990025702 Air Force Medical Center, 59th Medical Wing, Lackland AFB, TX USA
Trauma Surgery for Contingency Operations: Test Based Improvements
Carlton, P. K., Air Force Medical Center, USA; Putnam, A. Tyler, Air Force Medical Center, USA; Bradley, Donald, Air Force Medical Center, USA; Coopwood, Joseph, Air Force Medical Center, USA; Pilcher, John, Air Force Medical Center, USA; September 1998; 4p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A01, Hardcopy; A04, Microfiche

This paper describes work undertaken at Wilford Hall Medical Center for testing and quantification of practice changes planned to facilitate the concept of ”forward resuscitative surgery.” This paper will begin by discussing the rationale for and composition of the Mobile Field Surgical Team (MFST). It n will then proceed to discuss the challenges that arose in the formation of the team and it’s concepts of operation, with a description of several areas in which we have performed objective testing of the proposed new practices. I will describe our evaluation of the following areas: (1) instrument disinfection technique that does not

use an autoclave; (2) live surgery using a pared-down equipment package; (3) trauma surgery without visible light; and (4) possible application of thermal imaging to commonplace medical care
Derived from text
Surgery; Procedures; Antiseptics; Thermal Mapping

19990025703 Air Force Medical Center, 59th Medical Wing, Lackland AFB, TX USA
Temporary Arterial Shunts for Management of Major Extremity Arterial Injury: A Field Expedient Bridge to Definitive Surgical Reconstruction
Dawson, David L., Air Force Medical Center, USA; Light, Jerry T., Air Force Medical Center, USA; Putnam, A. Tyler, Air Force Medical Center, USA; Kissinger, David P., Air Force Medical Center, USA; Bradley, Donald V., Air Force Medical Center, USA; September 1998; 8p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Shunts were successfully placed and patency maintained 24 hours in all 8 animals. Shunt malposition with subsequent thrombosis requiring thrombectomy and repositioning occurred in one pig during the 4th hour of the experiment; this was successfully corrected and the shunt remained patent throughout the remainder of the experiment. Flow data from two animals was not able to be analyzed-one developed malignant hyperthermia which caused a hyperdynamic state, skewing the data; and the second had incomplete flow data due to equipment malfunction. This graph depicts the flow data comparing he control and shunted limbs. Although the flow through the shunted limbs was significantly lower than that of the non-shunted ones ($p = 0.0015$), the shunted limbs remained warm and well-perfused without any clinical evidence of ischemia. Flow rates did not differ significantly over time in either the shunted or control limbs.
Derived from text
Arteries; Hyperthermia; Thrombosis; Surgery; Flow Velocity; Bypasses

19990025704 Hemosol, Inc., Etobicoke, Ontario Canada
Blood Substitutes in Contingency Operations
Magnin, Anthony A., Hemosol, Inc., Canada; Carmichael, F. J. Lou, Hemosol, Inc., Canada; September 1998; 8p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

For many years there has been a concerted effort by both industry and the military to develop blood substitutes. Such products are expected to be well-suited for use in emergency/trauma settings where the timely provision of fully cross-matched blood for resuscitation and/or transfusion may be difficult and prohibitively expensive. The use of cell free hemoglobin solutions as a safe and effective adjunct or alternative to red blood cell transfusion has long intrigued and challenged medical practitioners dealing with the various aspects of trauma, elective and emergency surgery, and other branches of medicine. Interest in this field has been heightened by concerns of the safety of blood and blood products, particularly in terms of possible contamination with infectious agents. There are still concerns about transmission of blood-borne diseases during the ”window period” when infectious agents may be present, but antibodies are not yet detectable in blood using current methods. In addition, the incidence of immune suppression, occasional accidental mismatching of blood and recipient, and the extent of both major and minor reactions associated with blood transfusion continue to cause concern.
Derived from text
Blood; Hemoglobin; Resuscitation; Contingency; Surgery; Cells (Biology)

19990025705 Ministry of Defence, Direzione Generale della Sanita Militare, Rome, Italy
A Worldwide Epidemiological Survey on the Infrastructure for Prevention of Communicable Diseases in the Military
dAmelio, R., Ministry of Defence, Italy; Heymann, D. L., World Health Organization, Switzerland; September 1998; 6p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Infectious diseases represent a heavy burden for mankind. In 1995 infectious diseases were responsible for more than 17 million (33%) of nearly 52 million deaths worldwide. Among these infectious diseases, 65% were those characterized by person-to-person transmission, such as the sexually and air-borne transmitted diseases, followed by food, water and soil-borne (22%), insect-borne (13%) and animal-borne (0.3%) diseases. They include, in order of importance, acute respiratory infections (4.4 million deaths/year), followed by diarrhoeal diseases (3.1 million deaths/year), tuberculosis (3.1 million deaths/year) malaria (2.1 million deaths/year), hepatitis B (1.1 million deaths/year), HIV/AIDS (greater than 1 million deaths/year), neonatal tetanus (500,000 deaths/year), whooping cough (355,000 deaths/year) and lastly roundworm and hookworm (165,000 deaths/year)
Derived from text
Infectious Diseases; Epidemiology; Prevention; Parasitic Diseases; Surveys

19990025706 Joint United Nations Programme on HIV/AIDS, Geneva, Switzerland

Prevention of HIV Infection and Sexually-Transmitted Diseases in Contingency and Peacekeeping Operations

Kingma, Stuart J., Joint United Nations Programme on HIV/AIDS, Switzerland; September 1998; 6p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Armed forces personnel are at special risk for exposure to STDs and HIV. The HIV risks are related to sexual activity and injecting drug use, and they are much higher during deployment. Military readiness can be compromised by these diseases through sick leave, loss of training input, loss of experience/skills, and cost of replacement training. HIV-positive personnel jeopardise field safety of blood supplies during contingency operations. Providing first aid in the field is also more complicated, and interaction with the local population carries its special risks.

Derived from text

Infectious Diseases; Risk; Prevention

19990025707 Zurich Univ., Div. of Epidermiology and Prevention of Communicable Diseases, Switzerland

Priorities in Immunizations for Peacekeeping Forces

Steffen, Robert, Zurich Univ., Switzerland; September 1998; 8p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Previous experience shows wide differences in the immunizations status among contingents arriving from different nations for peacekeeping missions. This seems to be due to lack of knowledge, lack of coordination, and lack of financial support. to obtain logical priorities for immunizations in peacekeeping forces, one must primarily assess the risk of infection, to a lesser degree consider the impact of infection. Host factors, legal aspects and vaccine safety and efficacy also play a role. Usually, peacekeeping missions take place in regions with impaired hygienic conditions, in non-immunes, the risk is greatest for hepatitis A, hepatitis B, thyphoid fever and measles in most countries. Yellow fever, Japanese encephalitis. poliomyelitis, and plague are of no concern at many destinations, but the risk may be substantial at others. Cholera, diptheria, rabies, tetanus and tuberculosis are a lesser, albeit almost worldwide risk for troops. Depending on the type of mission, immunization against influenza needs to be considered. Future oral vaccines against gastrointestinal infections may become relevant issues in the near future.

Author

Immunology; Infectious Diseases; Vaccines; Priorities; Risk; Safety

19990025708 School of Aerospace Medicine, Flight Medicine Branch, Brooks AFB, TX USA

Compliance with Anti-Malarial Preventive Measures by Deploying USAF Personnel for Operation Assured Response

Williams, Christopher S., School of Aerospace Medicine, USA; Aeromedical Support Issues in Contingency Operations; September 1998; 4p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A01, Hardcopy; A04, Microfiche

The results of this study also indirectly suggest that reducing exposure in-country is a very important factor. If keeping personnel indoors can be accomplished, mosquito bite exposure, especially during evening hours when they are most active in feeding, would be benefical. If sleeping indoors is accomplished with the issuance and proper use of mosquito netting.

Derived from text

Military Operations; Exposure; Insects; Nets

19990025709 Army Medical Research Inst. of Infectious Diseases, Operational Medicine Div., Fort Detrick, MD USA

Air Evacuation Under High-Level Biosafety Containment: The Aeromedical Isolation Team

Christopher, George W., Army Medical Research Inst. of Infectious Diseases, USA; Eitzen, Edward M., Jr., Army Medical Research Inst. of Infectious Diseases, USA; September 1998; 10p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Contingency operations in tropical environments and the potential use of biological weapons by adversaries place troops at risk for potentially lethal contagious infections. Examples include viral hemorrhagic fevers, plague, and zoonotic poxvirouses. Rapid diagnosis and basic research regarding countermeasures for such illnesses would be facilitated by evacuating a limited number of patients to a facility with containment laboratories. In order to safely evacuate such patients to our institute via military aircraft and to minimize the rick of transmission ti air crews, care givers, and civilian communities, the U.S. Army Medical Research In stitute of Infectious Diseases has developed an Aeromedical Isolation Team (AIT). The AIT is a rapid response team with worldwide airlift capability designed to evacuate and manage patients under high level containment. Teams consist of a physician, a registered nurse, and four to six medics. The teams are accompanied by a fully functioning diagnostic laboratory utilizing genetic typing methods and immunoassays. Protective equipment includes impermeable protective suits equipped with powered

HEPA-filtered respirators and patient isolators equipped with negative-air pressure, HEPA-filtered ventilation system. Technical aspects of AIT equipment, training, deployments, and capabilities are discussed.
Derived from text
Aerospace Medicine; Infectious Diseases; Viruses; Medical Science; Flight Crews

19990025711 Military Satellite Command, Command and Control Systems Electronic Systems Center, Hanscom AFB, MA USA
Evolution of a Global Military and Civilian Telemedicine Network for the 21st Century: Near Future on Demand, Space Based Delivery of Multimedia Services
Evans, John A., Military Satellite Command, USA; Davidson, Frank, Massachusetts Inst. of Tech., USA; Sanders, Jay, American Telemedicine Association, USA; McInerney, Thomas G., Business Executives for National Security, USA; Brandon, William T., Mitre Corp., USA; Row, Lockard M., Row (Lockard M.), USA; September 1998; 22p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper stresses the more recent intraregional telemanagement and telemedicine efforts and synthesizes key success factors essential for evolving self-sustaining global telemanagement and telemedicine networks for the twenty-first century. Finally, future directions are proposed which could adapt these kinds of networks to bring about healthier military and civilian communities.
Derived from text
Telemedicine; Biotelemetry; Medical Electronics; Teleconferencing; Telecommunication; Military Operations

19990025712 Army Medical Research and Development Command, Telemedicine and Advanced Technology Research Center, Fort Detrick, MD USA
Telemedicine in Support of Operations in Remote Locations
Morris, Tommy, Army Medical Research and Development Command, USA; Vandre, Robert H., Army Medical Research and Development Command, USA; Rocca, Mitra, Army Medical Research and Development Command, USA; Roller, Jeffrey I., Army Medical Research and Development Command, USA; Salisbury, Timothy, Army Medical Research and Development Command, USA; September 1998; 1p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A01, Hardcopy; A04, Microfiche

USA military services deploy to isolated locations with integral medical support. In most small deployments the unit has a General Medical Officer and/ or a Physician's Assistant as well as a compliment of Medics to provide primary medical care to the assigned personnel. The goal of telemedicine is increase the quality of care given to the soldiers by providing access to specialty providers utilizing satellite communications and commercial off the shelf technologies.
Derived from text
Telemedicine; Deployment; Medical Science; Medical Equipment; Medical Electronics; Biotelemetry

19990025713 Air Force Medical Center, 59th Medical Wing, Lackland AFB, TX USA
The Potential Uses of Telemedicine to Augment Critical Care In-the-Air
Farmer, J. Christopher, Air Force Medical Center, USA; Carlton, P. K., Jr., Air Force Medical Center, USA; Kilpatrick, Russell, Air Force Medical Center, USA; Derdak, Steven, Air Force Medical Center, USA; Beninati, Bill, Air Force Medical Center, USA; Grissom, Thomas, Air Force Medical Center, USA; September 1998; 3p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A01, Hardcopy; A04, Microfiche

Recent advances have allowed us to expand the relm of intensive care medicine into the aeromedical evacuation arena. The rate limiting step to the full scale development of this concept is sufficient numbers readiness directed numbers would not be gainfully employed during a peace time environment. Therefore, we must look to alternate personnel sources to provide this care with sophisticated medical backup. In this regard, telemedicine provides an excellent vehicle to leverage the sophisticated medical care into the hands of other healthcare providers with intensivists backup. Air to ground telemedicine may expand the functionality of available non-physical providers during military medical contingency operations.
Derived from text
Telemedicine; Military Operations; Medical Services; Air Transportation; Medical Equipment; Teleconferencing

19990025714 Georgetown Univ., Medical Center, Washington, DC USA
Light Weight and Portable Telemedicine Workstations: The MUSTPAC Experience
Macedonia, Christian R., Georgetown Univ., USA; Littlefield, Rik, Georgetown Univ., USA; Eglinton, Gary, Georgetown Univ., USA; Skelly, Larry, Georgetown Univ., USA; September 1998; 3p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A01, Hardcopy; A04, Microfiche

Advanced imaging and telecommunications capabilities are becoming commonplace in major university hospitals. The availability od such services to people in remote or deployment environments is not always certain. to address this issue, the US Army and Battelle Memorial Institute developed a family of telemedicine workstations. One device, the MUSTPAC (Medical Ultra-Sound, Three-dimensional and Portable with Advanced Communications) was deployed to the 212th Mobile Army Surgical Hospital in Tuzla, Bosnia-Herzegonvina in a feasibility study investigating its potential as a remote diagnostic tool.
Author (revised)
Telemedicine; Imaging Techniques; Ultrasonics; Military Operations

19990025715 Air Force Medical Center, Telemedicine Technology Area Directorate, Lackland AFB, TX USA
StatRad: A Portable Imaging Center for Remote/Hostile Environments
Freckleton, M. W., Air Force Medical Center, USA; Johnson, Thomas G., Army Medical Research and Materiel Command, USA; September 1998; 4p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A01, Hardcopy; A04, Microfiche

Until very recently, radiological imaging centers have been restricted to large medical institutions within large, fixed facilities. Although there is no diminution in the need for factors including equipment size, weight, power/water supply, narrow temperature thresholds, etc., have precluded all but the most rudimentary radiological imaging in austere locations. StatRad is an ongoing effort to develop not only imaging equipment, but the components of an integrated and scaleable imaging center for use in circumstances which cannot be controlled for environmental factors, and where the medical response must rapid and decisive.
Derived from text
Imaging Techniques; Radiology; Image Classification; Image Enhancement; Aerospace Medicine

19990025716 Militair Hospitaal Dr. A. Mathijsen, Dept. of Radiology, Utrecht, Netherlands
Teleradiology in the Armed Forces of The Netherlands
Prins, H. J., Militair Hospitaal Dr. A. Mathijsen, Netherlands; September 1998; 4p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A01, Hardcopy; A04, Microfiche

In general terms the telemedicine project of the Armed Forces of the Netherlands is described. The system is not suited for use during acute situations in the field with large numbers of casualties. The surgical team will then be busy with life and limb saving procedures. In a later phase the results of the treatment. Problems experienced in the past are discussed. Telemedicine will never be a substitution for medical or surgical expertise in the field.
Derived from text
Telemedicine; Teleconferencing; Medical Services; Biotelemetry; Substitutes; Armed Forces; Casualties

19990025717 Mobile Army Surigical Hospital (212th), USA
Contingency Operations: The Challenging New Paradigm
Moloff, Alan L., Mobile Army Surigical Hospital (212th), USA; September 1998; 4p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A01, Hardcopy; A04, Microfiche

For almost 50 years NATO forces planned and trained for the defence of western Europe. The fall of the Soviet Union and the breakup of the Warsaw Pact has greatly changed the focus of NATO and other military forces is Contingency Operations (CONOPS). This paper will discuss planning factors and considerations for medical support of CONOPS.
Derived from text
North Atlantic Treaty Organization (NATO); Contingency; Peacetime; Military Psychology; Psychological Effects

19990025718 Centro de Instruccion de Medicina Aeroespatial, Madrid, Spain
Stress Factors in the SPAF Personnel Assigned to Humanitarian and Peace Keeping Operations
Cruz, Jesus Medialdea, Centro de Instruccion de Medicina Aeroespatial, Spain; Tejada, Francisco Rios, Centro de Instruccion de Medicina Aeroespatial, Spain; September 1998; 12p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

In this paper we describe and analyze the stress factors associated to a sample of military personnel currently in flying status, who has been deployed in critical area where a wide range of missions has been conducted. In addition to that, we have studied the adaptation to the possible techniques to minimize such aeromedical issue. In order to evaluate this medical aspects, an interview and survey of factors related to perception of stress has been conducted according to a cognitive model of stress.
Derived from text
Stress (Psychology); Peacetime; Military Operations; Military Psychology; Psychological Tests; Psychological Effects

19990025719 National Defence Headquarters, Personnel Research Team, Ottawa, Ontario Canada

A Conceptual Approach to the Study of Stress in Peacekeeping Personnel

Murphy, P. J., National Defence Headquarters, Canada; Farley, K. M. J., National Defence Headquarters, Canada; Dobreva-Martinova, T., National Defence Headquarters, Canada; September 1998; 3p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A01, Hardcopy; A04, Microfiche

This paper outlines the current conceptual model utilized in Canadian Forces psychological research of the stress of peace operations. The model incorporates stressor, moderator, outcome and intervention components at the individual, group and organizational levels. Previous research has illustrated many of the various sources of stress on peace operations. Individual and organizational level resources that could serve as moderators of operational stress include individual coping skills, satisfiers of the peacekeeping experience, perceived organizational support and unit climate. Outcome measures include signs and symptoms of stress: both commonplace and more serious stress reactions. Other outcome and intervention components will be explored in future research. This theoretical framework should aid our understanding of the human dynamics of the deployment cycle and suggest appropriate training and interventions to enhance individual and organizational well-being and performance.

Derived from text

Stress (Psychology); Peacetime; Military Psychology; Psychological Effects; International Cooperation

19990025720 National Defence Headquarters, Personnel Research Team, Ottawa, Ontario Canada

Stress in Peace Support Operations: Recent Canadian Experiences

Murphy, P. J., National Defence Headquarters, Canada; Farley, K. M. J., National Defence Headquarters, Canada; Dubreva-Martinova, T., National Defence Headquarters, Canada; Gingras, C., National Defence Headquarters, Canada; September 1998; 4p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A01, Hardcopy; A04, Microfiche

The Canadian Forces continues its high profile involvement in peace operations in various parts of the world. At present, over 2000 Canadian Forces personnel are deployed overseas in the peace support roles, largely in Bosnia and Haiti. A long-term research project into the human dimension of operational performance has monitored several aspects of deployments. The paper addresses research findings relating to the stress of peace support operations and other human factors. Select details of significant stressors, the stress-strain relationship and several moderating factors (satisfiers, group cohesion, coping styles and perceptions of organizational support) are presented.

Derived from text

Military Psychology; Military Operations; Human Performance; Perception; Personnel; Stress-Strain Relationships; International Cooperation

19990025721 Army of the Czech Republic, SFOR Monitoring Center, Prague, Czechoslovakia

Motivation Structures of the Czech SFOR Unit Members

Radova, Jana, Army of the Czech Republic, Czechoslovakia; September 1998; 7p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The Army of the Czeach Republic has been actively participating in the peace-keeping missions of the United Nations and NATO from 1991 until today. The goal of this paper is to describe the motivation structures that led our soldiers to participate in the last of the mentioned missions.

Derived from text

North Atlantic Treaty Organization (NATO); Military Operations; Peacetime; International Law; International Cooperation

19990025886 Naval Health Research Center, San Diego, CA USA

Tonic, Phasic, and Transient EEG Correlates of Auditory Awareness in Drowsiness

Makeig, Scott; Jung, Tzyy-Ping; Apr. 1995; 14p; In English

Report No.(s): AD-A359336; NMRDC-95-1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

During drowsiness, human perfoimance in responding to above-threshold auditory targets tends to vary irregularly over periods of 4 min and longer. These pefformance fluctuations are accompanied by distinct changes in the frequency spectrum of the electroencephalo- gram (EEG) on three time scales: (I) during minute-scale and longer periods of intermittent responding mean activity levels in the (less than 4 Hz) delta and (4-6 Hz) fl%eta bands and at the sleep spindle frequency (14 Hz) are higher than during alert performance. (2) In most subjects, 4-6 Hz theta EEG activity begins to increase and gamma band activity above 35 Hz hegins to decrease, about 10 5 hefore pr-sentations of undetected targets, while hefore detected targets, 4-6 Hz amplitude decreases and gamma hand amplitude increases. Both these amplitude differences last 15-20 5 and occur in parallel with event-related cycles in target detection prohahility. In the same periods, alpha and sleep-spindle frequency amplitudes also show prominent 15-20 5 cycles, but these are not phase locked to pefformance cycles. (3) A second or longer after undetected targets, amplitude

at intermediate (10-25 Hz) frequencies decreases hriefly, while detected targets are followed by a transient amplitude increase in the same latency and frequency range.
DTIC
Electroencephalography; Frequency Distribution; Frequency Ranges; Intermediate Frequencies; Phase Locked Systems; Spindles

19990025895 Naval Facilities Engineering Service Center, Port Hueneme, CA USA
Lighterage Seasickness Parametric Study ***Final Report***
March, Robert; Palo, Paul; Dec. 1998; 15p; In English
Report No.(s): AD-A358668; NFESC-TM-2306-OCN; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report summarizes the results of a study performed to estimate seasickness corresponding to several different proposed configurations associated with the Joint Modular Lighterage System (JMLS). Specifically, the dynamic behavior of different modular barges with a heavy load was modeled in a variety of sea state 3 environments. This study consisted of identifying a single representative wave spectrum, running the SCORES vessel dynamics computer model for a variety of conditions (barge size, wave direction and water depth), and comparing the RMS vertical accelerations at various points on the barge deck. A literature survey was completed regarding seasickness criteria, which was then used to convert the RMS accelerations into seasickness potential for varying positions on the vessel.
DTIC
Computerized Simulation; Dynamic Characteristics; Loads (Forces); Sea States; Spectra

19990025934 Air Force Research Lab., Human Effectiveness Directorate, Brooks AFB, TX USA
Testing and Evaluation of the Heartstream, Inc., Model EM Semi-Automatic Defibrillator External ***Final Report, Sep. 98***
Sylvester, James C.; Dec. 1998; 17p; In English
Contract(s)/Grant(s): Proj-7184
Report No.(s): AD-A359533; AFRL-HE-BR-TR-1998-0121; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Heartstream, Inc., Model EM Semi-Automatic External Defibrillator is a portable, battery operated, semi-automatic defibrillator. It performs automatic self-tests and displays the results of these tests on a status indicator. The unit is equipped with a high resolution, liquid crystal display with back light screen that displays text prompts, patient and event information and single-lead electrocardiogram (ECG). The unit operates on a disposable 18 VDC lithium battery. The unit weighs approximately 4.34 lbs. with battery (5.8 lbs. with battery, case and defib pads) and is 8.75 in. W. (10 in. with case) X 2.5 in. H. (4.75 in. with case) X 8 in. D. (9.25 in. with case).
DTIC
Medical Equipment; Portable Equipment; Battery Chargers; Fibrillation; Electric Batteries; Electrocardiography

19990025955 Texas Univ., Dept. of Gynecologic Oncology, Houston, TX USA
Lineage-Negative Human Leukocyte Antigen-DR(+) Cells with the Phenotype of Undifferentiated Dendritic Cells in Patients with Carcinoma of the Abdomen and Pelvis
Melichar, Bohuslav, Texas Univ., USA; Savary, Cherylyn, Texas Univ., USA; Kudelka, Andrzej P., Texas Univ., USA; Verschraegen, Claire, Texas Univ., USA; Kavanagh, John J., Texas Univ., USA; Edwards, Creighton L., Texas Univ., USA; Platsoucas, Chris D., Texas Univ., USA; Freedman, Ralph S., Texas Univ., USA; Clinical Cancer Research; Mar. 1998; Vol. 4, pp. 799-809; In English; Sponsored in part by American Cancer Society
Contract(s)/Grant(s): NCC9-36; EDT-56; NIH RO1-CA64943; NIH MO1-RR02558; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The characteristics of antigen-presenting cells in carcinomas that involve the abdominopelvic cavity are unknown. Dendritic cells, a population of antigen-presenting cells, have been identified as lineage-negative human leukocyte antigen (HLA)-DR(+) cells by two-color flow cytometry. We used this criterion to study the putative dendritic cells in ascites from 25 patients with peritoneal carcinomatosis. The mean proportion +/-SD of lineage-negative HLA-DR(+) cells in ascites was 3.1 +/- 4.6% (range, 0.05-17.3%). Most lineage- negative HLA-DR(+) cells expressed CD45RA or CD4 antigens. Dendridc cells had low proportions of CD80, CD11c, CD45RO, and CD58, suggesting that they were of low maturity. The proportion of lineage-negative HLA-DR(+) cells in ascites of seven patients was significantly higher than the proportion in peripheral blood from the identical patients (4.5 +/- 5.7 versus 0.5 +/- 0.4; P is less than 0.05). In paired specimens of ascites and peripheral blood, the proportion of lineage-negative HLA-DR(+) cells that coexpressed CD86 or CD58 was significantly lower In ascites than in peripheral blood, whereas a higher proportion of lineage-negative HLA-DR(+) cells in ascites expressed CD4. Relative fluorescence intensity of HLA-DR(+) was also lower in dendritic cells from ascites and blood from patients with carcinomatosis than it was In blood from normal

donors. As an Indicator of macrophage activation, the concentration of neopterin in ascitic fluid correlated negatively with the numbers of lineage-negative HLA-DR(+) cells in ascites (Spearman correlation coefficient, -0.44; p=0.05) correlated positively with the concentration of interleukin 10 in ascitic fluid correlation coefficient, -0.04; p=0.05). IFN-gamma and tumor necrosis factor alpha were also not detected. These findings suggest that certain factors associated with the tumor microenvironment might influence the number of these dendritic cells and their expression of function-associated markers.
Author
Leukocytes; Pelvis; Abdomen; Antigens; Cavities; Biological Effects; Cancer

19990026292 Shock Society, Augusta, GA USA
Conferences on Shock and Cytokines ***Final Report, 14 Jun. 1998 - 31 May 1999***
Reichard, Sherwood M.; Dec. 08, 1998; 17p; In English
Contract(s)/Grant(s): N00014-98-1-0691
Report No.(s): AD-A359721; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Summary of Symposia at 21 St Annual Conference on Shock held in San Antonio, TX, June 14-17, 1998. Summary of Symposia at 6th International Cytokine Conference held in Jerusalem, Israel, October 20-25, 1999. Both Symposia were very successful. The Attached summaries describe the state of the art scientific progress being made in theses vital areas. Also Attached are abstract of all the papers delivered at the symposia.
DTIC
Conferences; Shock (Physiology); Physiological Responses

19990026439 Hunter Coll., New York, NY USA
Exposure of Human Cells to Electromagnetic Fields ***Final Report***
Henderson, Ann S.; Jan. 01, 1998; 8p; In English
Contract(s)/Grant(s): N00014-90-J-1266
Report No.(s): AD-A359992; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The objective of this research-was to find how exposure to extremely low frequency (elf) electric and magnetic fields (EMFs) affects human cells. It was previously postulated that EMFs initiate a transduction cascade at the cell membrane. If this is the case, then within minutes, a sequence of events, including early gene activation, could set up the initial steps leading to proliferation. A series of experiments were set up to determine the validity of this model by measuring specific proteins or protein groups. The results showed that some proteins are increased following exposure to a 60 Hz EMF for periods from 45 to 120 minutes. Other proteins, however, are either decreased or unaffected by the presence of the field.
DTIC
Cells (Biology); Electromagnetic Fields; Genetics; Exposure

19990026440 Operational Technologies Corp., San Antonio, TX USA
Subtle Measurement of Behavior Effects of Microwave Radiation ***Final Report, Feb. 1994 - May 1996***
Ziriax, John; Nov. 1998; 34p; In English
Contract(s)/Grant(s): F41624-92-D-4001; AF Proj. 7757
Report No.(s): AD-A360020; AFRL-HE-BR-TR-1998-0103; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The growing application of microwave (RF) technology has increased the potential for hazardous human exposures. The potential hazard posed by this expanding use of RF technology requires an ongoing study of RF bioeffects to keep pace with new applications and technologies. Furthermore, exposures to new and future sources are likely to involve RF power levels and exposure parameters (e.g., frequency, pulse width, peak power, etc.) which have yet to be studied. Effects on performance are among the most sensitive indices of biological effects and is a necessary part any research program to characterize RF hazards. In addition, many safety issues require understanding potential performance effects. For example, interference with self-rescue or task performance by RF exposure represent two performance mediated hazards.
DTIC
Microwave Equipment; Radiation Effects; Exposure; Biological Effects; Physiological Effects

19990026714 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Physiological Factors Correlating With a Possible Circadian Nadir in G-Tolerance
Wright, Bruce A.; Dec. 1998; 79p; In English
Report No.(s): AD-A359903; AFIT-FY99-73; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Circadian variation in athletic performance has been shown to have potentially significant performance consequences for the athlete. This study has attempted to determine whether there is a practical difference between day and night G-tolerance in order to warn pilots of possible adverse consequences due to circadian effects. The subjects' G-tolerance testing times were selected in order to highlight the potential maximum circadian differences. This study leads one to conclude that if there is a circadian effect on a pilot's G-tolerance, it is a small one, or this study would have shown it, and the Air Force should feel more confident to send pilots to fly and fight at night. However, other influences such as lack of sleep and/or extreme levels of stress did seem to have larger effects on pilots' G-tolerance than the proposed circadian effect. Additionally, research on the effect of lighting on suppression of melatonin prior to a nighttime mission should be further investigated.
DTIC
Circadian Rhythms; Acceleration Stresses (Physiology); Gravitational Physiology; Aerospace Medicine; Gravitational Effects

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BEHAVIORAL SCIENCES

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

19990025332 Oklahoma Univ., Dept. of Psychology, Norman, OK USA
Situation Awareness as a Predictor of Performance in En Route Air Traffic Controllers ***Final Report***
Durso, Francis T., Oklahoma Univ., USA; Hackworth, Carla A., Oklahoma Univ., USA; Truitt, Todd R., Oklahoma Univ., USA; Crutchfield, Jerry, Oklahoma Univ., USA; Nikolic, Danko, Oklahoma Univ., USA; Manning, Carol A., Civil Aeromedical Inst., USA; January 1999; 18p; In English
Contract(s)/Grant(s): DTFA02-93-D-93088
Report No.(s): DOT/FAA/AM-99/3; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this study, air traffic control instructors controlled simulated traffic while three techniques for determining situation awareness (SA) were implemented. SA was assessed using a self-report measure (SART); a query method that removed information on the plan-view display (SAGAT); a query technique that did not have a memory component (SPAM); and the detection of errors integrated into the scenarios (implicit performance). We used these measures of SA together with a measure of workload, NASA TLX, to predict two different performance measures. One performance measure was an over-the-shoulder, subjective assessment by a subject matter expert (SME). The other performance measure was a count of the number of control actions remaining to be performed at the end of the scenario. The SME evaluation was predicted by workload and the controller's appreciation of both the present and the future. The remaining-actions count (RAC) was predicted by the controller's appreciation of the future. In fact, an appreciation of the present led to poorer RAC scores: The better the participant was at answering questions about the present or the better he or she understood the present situation, the larger the number of actions remained to be performed. The results have implications for the relationships among workload, situation awareness, and performance, and suggest limitations on several of the measures currently proposed as SA techniques. The results confirm that future versus present is an important conceptual difference in air traffic control. More importantly, the results suggest that a controller who remains overly focused on the present may do so at the expense of the future.
Author
Air Traffic Control; Simulation; Performance Tests; Air Traffic Controllers (Personnel)

19990025333 Civil Aeromedical Inst., Oklahoma City, OK USA
The Role of Shift Work and Fatigue in Air Traffic Control Operational Errors and Incidents ***Final Report***
DellaRocco, Pamela S., Editor, Civil Aeromedical Inst., USA; January 1999; 32p; In English
Report No.(s): DOT/FAA/AM-99/2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report was developed from a collaborative effort between the FAA Civil Aeromedical Institute's (CAMI's) Shift Work and Fatigue Research Program and the National Aeronautics and Space Administration (NASA) Ames Research Center's Fatigue Countermeasures Program. The purpose of this report was to examine existing databases to assess the extent to which shift work and fatigue might be factors associated with incidents and errors in air traffic control (ATC) operations. The first study in this report examined the Aviation Safety Reporting System (ASRS) database, a voluntary reporting system administered and maintained by NASA. The ASRS database was searched for reports concerning ATC incidents. of the 5773 ATC reports in the database, a search of 19 fatigue-related keywords identified 153 (2.7%) reports referencing controller-related fatigue in the narrative section of the ASRS incident report. These reports spanned the years from 1988 to 1996. These reports were categorized by year of occurrence, aircraft type, fatigue category, incident type, time of day, day of the week, and lighting condition. Controller fatigue was the most commonly identified category in the 153 fatigue-related reports, followed by workload and duty or scheduling factors. Fatigue

was reported as a performance-impairing factor affecting personnel at all times of the day, in all types of operations, and manifested itself in a variety of anomalies in ATC operations. The second study in this report examined the Operational Error/Deviation System (OEDS) database, a mandatory reporting system managed and operated by the FAA. A total of 3222 records was examined. These reports spanned the years from 1988 to 1994. The analyses in this study included: (1) descriptive statistics for shift work-related variables; 2) correlations between shift work variables and severity of OEDS; and (3) Chi-square analyses of causal factors and shift type. Frequency counts revealed that 80% of OEDs occurred between 0800 and 1900 and nearly 50% of errors occurred within the first 30 minutes on position, usually upon returning from a break. None of the shift work variables was a strong predictor of the severity of operational errors. Data-posting types of errors were more likely on the midnight shift, possibly reflecting declines in alertness and vigilance on that shift. Unfortunately, many of the variables related to shift schedules and fatigue were unable to support much analysis because of data quality problems and confounding with air traffic volume. to adequately assess the changes in OED rates as they relate to time of day, in estimate of exposure is needed.
Author
Air Traffic Control; Schedules; Workloads (Psychophysiology); Alertness; Errors; NASA Programs; Aircraft Safety; Fatigue (Biology)

19990025683 Air Force Research Lab., Sustained Operations Branch, Brooks AFB, TX USA
Evaluating Crew Performance After Anti-Emetics: A Screen for Assessing Militarily Relevant Medications
French, Jonathan, Air Force Research Lab., USA; Benline, Terry A., Air Force Research Lab., USA; Poole, Eric, Air Force Research Lab., USA; September 1998; 10p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Prophylactic, pharmaceutical countermeasures hold the potential to protect aircrews from a wide variety of threats during contingency operations, ranging from fatigue to radiation exposure. In order to assess the impact of these potential countermeasures on cognitive abilities, a 2-phase drug screen was developed. A battery of cognitive, affective and physiological measures was utilized in Phase I of testing to rapidly evaluate the performance liability of militarily relevant compounds. The carefully controlled Phase I lab study incorporated diurnal and nocturnal performance trials to assess potential drug interactions with circadian and sleep deprivation effects. During Phase II, flight performance was tested in a high fidelity aircraft simulator using embedded operational tasks, expert evaluation and subjective metrics. The Phase I screen evaluated two novel anti-emetic compounds, granisetron (2 mg) and ondansetron (8 mg), compared to placebo and a positive control, prochlorperizine (10 mg), in a double blind, crossover study of 24 subjects. Performance was assessed hourly from 1800 until 0200. All Phase I metrics were degraded during nocturnal performance trials for all drug conditions, presumably due to circadian and sleep deprivation effects. The positive control was identified by the divided attention task in terms of accuracy (p less than 0.05) and reaction time (p less than 0.05) and by the mean lambda for the tracking task (p less than 0.05), but only during a time when blood levels of prochlorperizine were elevated. None of the affective state questionnaires were able to identify the positive control, suggesting that the dose was low enough that the participants were unable to discern it. None of the target anti-emetic compounds differed from placebo suggesting that they were not likely to affect sensitive performance. Phase II also revealed no differences between target anti-emetic compounds and placebo in any of the segments of an F-16 defensive counter-air mission flown by 9 pilots. Based on these tests, the target compounds were considered safe to use prophylactically, with respect to cognitive ability, for crews in danger of radiation exposure. The utility of the drug screen as a rapid and thorough means to assess the cognitive impact of militarily relevant compounds was established.
Author
Performance Tests; Countermeasures; Antiemetics and Antinauseants; Flight Crews; Drugs; Human Performance; Radiation Dosage; Sleep Deprivation

19990025684 Clarke Inst. of Psychiatry, Toronto, Ontario Canada
Melatonin and its Role in Circadian Rhythm Disruption
Brown, Gregory M., Clarke Inst. of Psychiatry, Canada; Vos, Evert C., Clarke Inst. of Psychiatry, Canada; September 1998; 10p; In English; See also 19990025670; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Melatonin, the hormone of the pineal gland, is secreted during the hours of darkness with virtually no secretion during light and has therefore been called the hormone of darkness. Its secretion is controlled by an endogenous rhythm generating system that is entrained by light. Melatonin has a role in cuing circadian rhythms, notably the sleep-wake rhythm, promoting sleep, and contributing significantly to the circadian rhythm in body temperature. Specific receptors for melatonin have been cloned recently which mediate these and other effects. (Melatonin can be given orally, intravenously, by nasal spray or transbucally and has a wide safety margin.) Administration of melatonin orally (in a dose of 0.5 to 5 mg) or light treatment (300 to 5000 lux) has established therapeutic actions in circadian rhythm sleep disorders, including disorders associated with jet lag, shift work, delayed phase sleep

disorder, periodic sleep disorder in blindness and sleep and behavioural disorders in children with multiple brain damage. Treatment of circadian rhythm disorders with light or melatonin requires an understanding of the manner in which these agents produce effects on body rhythms. Effects of light and melatonin treatment follow a phase response curve. Evening light treatment causes a phase delay in the sleep-wake cycle while morning light causes a phase advance. As is befitting the hormone of darkness, melatonin treatment produces effects which are nearly the mirror image of light.
Author
Circadian Rhythms; Light (Visible Radiation); Sleep; Hormones; Regulatory Mechanisms (Biology)

19990026497 Civil Aeromedical Inst., Oklahoma City, OK USA
Predictors of Perceived Empowerment: An Initial Assessment ***Final Report***
Thompson, Richard C., Civil Aeromedical Inst., USA; Bailey, Lawrence L., Civil Aeromedical Inst., USA; Farmer, William L., Civil Aeromedical Inst., USA; Sep. 1998; 14p; In English
Report No.(s): DOT/FAA/AM-98/24; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Empowerment of employees regarding their work procedures is considered an important approach to improved organizational effectiveness. Recent research suggests that employee empowerment is related to a number of variables besides organizational structure and the use of teams. The present paper examined a number of organizational context variables, obtained from three samples in two government agencies. Perceptions of empowerment were then predicted from these context variables. The results show that perceptions of communication are the strongest predictor of empowerment perceptions across samples. In addition, the size of the communication slope estimate (B value) did not differ across the sample. The results support the contention that context factors besides teams and restructuring are related to empowerment. Specifically, communication perceptions are consistently the strongest predictor across samples and measures. Future research should examine the mechanisms that relate communication and empowerment.
Author
Research; Management Planning; Improvement; Workloads (Psychophysiology)

54
MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing. For related information see also 16 Space Transportation.

19990025334 Civil Aeromedical Inst., Oklahoma City, OK USA
Concepts Providing for Physiological Protection after Aircraft Cabin Decompression in the Altitude Range of 60,000 to 80,000 Feet Above Sea Level ***Final Report***
Garner, Robert P., Civil Aeromedical Inst., USA; February 1999; 18p; In English
Report No.(s): DOT/FAA/AM-99/4; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The European aircraft Concorde provides evidence that the technology required for building supersonic passenger transport has long been available. In the USA, development efforts for this type of airplane were functionally abandoned in the early 1970s. In recent years, changes in technology, world political structures, and economics have stimulated interest in the development of a fleet of supersonic transports for use in civilian aviation. The future aircraft has been designated the High Speed Civil Transport (HSCT). As part of the development process, all potential challenges associated with design characteristics of the aircraft must be addressed. This report reviews the physiological issues related to cabin decompression during high-altitude flight. A number of strategies for protecting passengers and crewmembers after high-altitude cabin decompression are discussed. Due to the physiological consequences associated with high-altitude decompression, a combination of protective systems may be necessary. At a minimum, it would appear that increased structural integrity of the cabin, a repressurization system, and an optimally designed supplemental oxygen system for crew and passengers are required.
Author
Aircraft Compartments; Pressure Reduction; Structural Failure; Design Analysis; Physiology; High Altitude

19990025584 Montana State Univ., Bozeman, MT USA
More Favored than the Birds: The Manned Maneuvering Unit in Space, Chapter 13
Millbrooke, Anne, Montana State Univ., USA; From Engineering Science to Big Science: The NACA and NASA Collier Trophy Research Project Winners; 1998, pp. 299-319; In English; ISBN 0-16-049640-3; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Manned Maneuvering Unit (MMU) gave astronauts the ability to maneuver in outer space, outside of the spacecraft free of tether lines. This allows the astronauts the freedom to engage in extravehicular activity independent of the constraints of a tether. Without the development of protective, pressurized suits capable withstanding the extremes of outer space, the manned maneuvering unit would not have been useful. Thus there is included in this essay, a description of the development of the space suits. The first use of the MMU was in 1984, and involved testing the unit for the rescue of the Solar Max satellite. The MMU has not been used since 1984. This is due in part because extravehicular activity has been as effective using tethers, safety grips, hand holds and other restraints. The development of the robotic arm has proved effective at retrieving errant satellites, and the MMU has not had a mission, or a customer.
CASI
Extravehicular Activity; Manned Maneuvering Units; Rescue Operations; Space Suits; Self Maneuvering Units

19990025599 Institute of Space Medico, Beijing, China
Some problems in constructing human body impact dynamic model
Liu, Bingkun, Institute of Space Medico, China; Space Medicine and Medical Engineering; October 1996; ISSN 1002-0837; Volume 9, No. 5, pp. 381-384; In Chinese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

In manned spaceflight, human body is subjected to various dynamic factors (impact, vibration, etc.), and impact force may cause damages to human tissues and organs. Human body impact dynamic model is discussed from the following aspects: type of the model, the number of degrees of freedom, characteristics of the model, selection of the physical parameters, nonlinear problems, verification and application of the model and so on. The model should be constructed on the basis of reasonable hypotheses and reliable experimental data and the key to the question is the determination of the physical parameters in the model. The model verified by tests will be of wide application in manned spaceflight: it can be used for calculating human body dynamic response to impact, optimizing parameters of preventive systems to minimize the injury and determining the limits of human impact exposure.
Author
Human Body; Dynamic Models; Dynamic Response; Impact Damage; Vibration; Biodynamics

19990025600 Institute of Space Medico, Beijing, China
Measurement and estimation of flow distribution of air allocated module in air ventilated suit
Yu, Xuejun, Institute of Space Medico, China; Wu, Jianmin, Institute of Space Medico, China; Xu, Guolin, Institute of Space Medico, China; Wang, Xianzhang, Institute of Space Medico, China; Space Medicine and Medical Engineering; October 1996; ISSN 1002-0837; Volume 9, No. 5, pp. 369-372; In Chinese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Flow distribution (FD) of an air allocated module in air ventilated suit was measured and calculated. The results indicate that the module's FD to head, arms, and legs are 35%, 35%, 30% respectively under normally used steady air flow (100-160 L/min). There was no stable FD when the flow fluctuated or air supply to the module was insufficient. The method used in this work is simple and reliable and an algorithm for estimating the FD by measuring flow resistance was established. The error of calculated FD is less than 2% comparing with the measured FD.
Author
Flow Measurement; Air Flow; Ventilation; Spacecraft Modules; Space Suits; Flow Resistance

19990025605 Institute of Space Medico, Beijing, China
A new method of oxygen generation inside a small biocabin
Li, Xianggao, Institute of Space Medico, China; Chen, Mei, Institute of Space Medico, China; Space Medicine and Medical Engineering; October 1996; ISSN 1002-0837; Volume 9, No. 5, pp. 377-380; In Chinese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The metabolism of insects and the seeds are low and the oxygen consumptions are small. Therefore a new method was developed for life support system inside the small biocabin on board satellite. Potassium superoxide was wrapped in a polypropylene membrane. Carbon dioxide can penetrate this membrane and revivify the potassium superoxide directly to regenerate oxygen. Part of the carbon dioxide was absorbed by lithium hydroxide to balance the oxygen partial pressure so that its fluctuation can be maintained within +/-10%. Experiment on board biosatellite proved that the system works well for seeds and insects.
Author
Oxygen Production; Oxygen Supply Equipment; Lithium Hydroxides; Life Support Systems; Biosatellites; Spacecraft Cabins; Insects; Seeds

19990025618 Institute of Aviation Medicine, Beijing, China

An assessment of +Gz protection afforded by different extended bladder coverage anti-G suits

Geng, Xichen, Institute of Aviation Medicine, China; Zhan, Changlu, Institute of Aviation Medicine, China; Yan, Guiding, Institute of Aviation Medicine, China; Lu, Xia, Institute of Aviation Medicine, China; Chu, Xu, Institute of Aviation Medicine, China; Zhang, Lifan, Fourth Military Medical Univ., China; Space Medicine and Medical Engineering; October 1996; ISSN 1002-0837; Volume 9, No. 5, pp. 317-323; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Three extended bladder coverage (EBC,) anti-G suits were evaluated on the centrifuge and were compared with the standard(Std) KH-3 five bladder and the full coverage capstan(FCC) anti-G suits. Bladders of the Std and three EBC anti-G suits covered approximately 30%, 43%, 65%, and 90%, respectively, of the lower body measuring from the umbilicus. Relaxed +Gz tolerances were determined in 5 subjects wearing these anti-G suits by rapid onset centrifuge runs (ROR). Protection afforded by Std, EBC (43%, 65%, and 90%)and FCC anti-G suits were 1.45, 2.13, 2.80, 3.60, and 1.85 G, respectively. However, at +5Gz(with anti-G suit inflation) exposures, HR with the 65% and the 90% EBC anti-G suits were significantly (P less than 0.01) lower than that with the Std anti-G suit. These results indicated that EBC anti-G suits significantly enhanced +Gz tolerance and reduced HR as compared with the Std anti-G suit.

Author

Acceleration Tolerance; Acceleration Stresses (Physiology); Pressure Suits

19990025825 NASA Johnson Space Center, Houston, TX USA

EVA Roadmap: New Space Suit for the 21st Century

Yowell, Robert, NASA Johnson Space Center, USA; HEDS-UP Mars Exploration Forum; 1998, pp. 59-60; In English; See also 19990025822; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

New spacesuit design considerations for the extra vehicular activity (EVA) of a manned Martian exploration mission are discussed. Considerations of the design includes:(1) regenerable CO2 removal, (2) a portable life support system (PLSS) which would include cryogenic oxygen produced from in-situ manufacture, (3) a power supply for the EVA, (4) the thermal control systems, (5) systems engineering, (5) space suit systems (materials, and mobility), (6) human considerations, such as improved biomedical sensors and astronaut comfort, (7) displays and controls, and robotic interfaces, such as rovers, and telerobotic commands.

CASI

Astronauts; Carbon Dioxide Removal; Extravehicular Activity; Life Support Systems; Mars (Planet); Portable Life Support Systems; Roving Vehicles; Space Suits; Manned Mars Missions; Robotics; Exobiology; Oxygen Supply Equipment; Waste Management

19990025826 NASA Johnson Space Center, Houston, TX USA

Crew Health and Performance on Mars

Stegemoeller, Charlie, NASA Johnson Space Center, USA; HEDS-UP Mars Exploration Forum; 1998, pp. 61-67; In English; See also 19990025822; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The issues surrounding the health and performance on Mars of a human crew are discussed in this presentation. The work of Human Space Life Sciences Program Office (HSLSPO) in the preparation of a crew for a Martian mission is reviewed. This includes a review of issues relating to human health and performance (HHP) in space and microgravity. The Mars design reference mission requires the most rigorous life sciences critical path of any manned mission in the forseeable future. This mission will require a 30 months round trip, with 4 different transistions to different gravities, and two episodes of high gravity load, during the Mars and Earth Aerobraking exercises. A graph is presented which shows the number of subjects with human space flight experience greater than 30 days. A chart presents the physical challenges to HHP in terms of gravity and acceleration and the length of times the crew will be exposed to the various gravity loads. Another chart presents the radiation challenges to the HHP for the duration of the trip. The human element is the most complex element of the mission design. Some challenges (i.e., human engineering and life support) must be overcome, and some issues such as bone loss, and radiation exposure must be addressed prior to making a decision for a manned Martian mission.

CASI

Aerospace Medicine; Bone Demineralization; Human Factors Engineering; Life Support Systems; Microgravity; Mission Planning; Radiation Dosage; Spacecrews; Manned Mars Missions; Bioastronautics; Astronaut Performance; Gravitational Effects

19990025827 NASA Johnson Space Center, Houston, TX USA

Preparing for Human Exploration

Drake, Bret G., NASA Johnson Space Center, USA; Joosten, B. Kent, NASA Johnson Space Center, USA; HEDS-UP Mars Exploration Forum; 1998, pp. 69-80; In English; See also 19990025822; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

NASA's Human Exploration and Development of Space (HEDS) Enterprise is defining architectures and requirements for human exploration that radically reduce the costs of such missions through the use of advanced technologies, commercial partnerships and innovative systems strategies. In addition, the HEDS Enterprise is collaborating with the Space Science Enterprise to acquire needed early knowledge about Mars and to demonstrate critical technologies via robotic missions. This paper provides an overview of the technological challenges facing NASA as it prepares for human exploration. Emphasis is placed on identifying the key technologies including those which will provide the most return in terms of reducing total mission cost and/or reducing potential risk to the mission crew. Top-level requirements are provided for those critical enabling technology options currently under consideration.

Author

Cost Reduction; Manned Mars Missions; Bioastronautics; Aerospace Medicine; Closed Ecological Systems; Radiation Tolerance; Weightlessness; Planetary Environments; Medical Science; Life Support Systems; Environmental Engineering; Physiological Effects; Human Factors Engineering; Spacecraft Propulsion

19990025828 NASA Lewis Research Center, Cleveland, OH USA

Power Systems for Human Exploration Missions

Cataldo, Robert L., NASA Lewis Research Center, USA; HEDS-UP Mars Exploration Forum; 1998, pp. 81-87; In English; See also 19990025822; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Power system options were reviewed for their appropriateness to meet mission requirements and guidelines. Contending system technologies include: solar, nuclear, isotopic, electro-chemical and chemical. Mission elements can basically be placed into two categories; in-space transportation systems, both cargo and piloted; and surface systems, both stationary and mobile. All transportation and surface element power system requirements were assessed for application synergies that would suggest common hardware (duplicates of the same or similar design) or multi-use (reuse system in a different application/location), wherever prudent.

Author

Mission Planning; Power Supplies; Electric Power Supplies; Spacecraft Power Supplies; Propellants; Mars (Planet); Manned Mars Missions; Mars Exploration

19990025834 Texas A&M Univ., College Station, TX USA

System Study of a Surface Habitat and a Transit Vehicle for a Manned Mission to and From Mars

Brown, Tony, Texas A&M Univ., USA; Hebert, Brian, Texas A&M Univ., USA; Hestilow, Colin, Texas A&M Univ., USA; Rogers, Jeff, Texas A&M Univ., USA; Sykes, Starlee, Texas A&M Univ., USA; McConnell, Joshua, Editor, Texas A&M Univ., USA; HEDS-UP Mars Exploration Forum; 1998, pp. 157-170; In English; See also 19990025822; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The continued technology advancement over the last several decades has provided the impetus for ambitious individuals to look towards exploration and possible settlement of the frontiers that exist beyond the boundaries of Earth. NASA has expressed a need for the development of a system to provide life sustaining functions for the duration of a three phase mission to and from Mars, including a 500 day expedition on the surface. A preliminary design for a Mars habitation and transportation system was developed to fulfill the need expressed by NASA after down-selecting from several conceptual designs. The design team assigned to this task was divided into subteams responsible for key function groups. These function groups are avionics, power and mobility, environmental controls and life support (ECLSS), and structures. This systems report gives an overview of the total system with attention given to each of these key functional groups. For further information and detail on a specific functional group, refer to the individual reports for that function group. The problem definition section of the report includes the need statement and need analysis, from which the specific need is expressed and the key system constraints imposed. The major functions resulting from the need analysis were that the habitation and transportation system must provide transportation, meet the constraints imposed by the shuttle, provide habitation needs, and allow for a Martian surface expedition. Following the function structure are the functional and performance requirements, which allocate specific numbers and constraints to particular concepts of the need. Calculations as well as assumptions are involved in the process of determining system performance requirements. The system description

contains basic drawings of the system and a description of major interfaces. A failure modes and effects analysis and a summary of component costs of the system are also included.
Author
Environmental Control; Functional Design Specifications; Life Support Systems; Mars Surface; Manned Mars Missions; Mars Exploration; Space Habitats; Closed Ecological Systems; Avionics; Space Rations

19990026123 Institute for Human Factors TNO, Soesterberg, Netherlands
Identification of Personnel Qualifications of Future Human-Machine Systems: An Exploration and Research Plan ***Final Report Identificatie van personeelskwalificaties van toekomstige mens-machine systemen: Een verkenning en onderzoeksplan***
Essens, P. J. M. D., Institute for Human Factors TNO, Netherlands; Riemersma, J. B. J., Institute for Human Factors TNO, Netherlands; Oving, A. B., Institute for Human Factors TNO, Netherlands; Sep. 09, 1998; 18p; In Dutch
Contract(s)/Grant(s): A97/KM/329
Report No.(s): TD98-0259; TM-98-A049; Copyright; Avail: Issuing Activity (TNO Human Factors Research Inst., PO Box 23, Kampweg 5, 3769 DE Soesterberg, The Netherlands), Hardcopy, Microfiche

Each system comprising an organization of people and machines assumes a certain competence with the people. Competence is the sum of the starting competence level, the general training, the function-specific training and operational experiences. Additional to the ergonomic factors, the personnel factors affect the feasibility and optimisation of the system design. As far as we know there is no systematic approach to deduce such affects. The research proposed seeks to develop such a systematic approach in the context of the research of function allocation and manning models for the future human-machine systems of the Royal Netherlands Navy.
Author
Man Machine Systems; Education; Systems Engineering

19990026200 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Nutrition and Food Research Inst., Zeist, Netherlands
Field Test with the Interim Arctic Ration ***Final Report Veldbeproevingen van het Interim Arctisch Rantsoen***
vanGemert, L. J., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; November 1998; In Dutch; Original contains color illustrations
Contract(s)/Grant(s): A98/KL/101
Report No.(s): TD98-0363; TNO-Voeding-V98.1032; Copyright; Avail: Issuing Activity (TNO Nutrition and Food Research Inst., P.O. Box 360, NL-3700 AJ Zeist, The Netherlands), Hardcopy, Microfiche

In the period February-March 1998 field tests were executed with the interim Arctic ration during military exercises in the Netherlands, Norway, Germany and France of Dutch army units of the marine corps, the 'Luchtmobiele Brigade' (air-mobile brigade) and the commando corps. For the field tests a total of 239 man filled in a questionnaire after having used the ration. The field tests were executed in conformity with the recent protocol for field tests of military rations. In general the interim Arctic ration was judged positively. Especially the snackpack was appreciated. Based on the answers given a list was made containing suggestions for specific improvements of the ration. Furthermore, based on the experiences obtained from the field tests a number of adjustments or improvements are suggested concerning the protocol for field tests of military rations.
Author
Field Tests; Rations; Armed Forces (Foreign)

19990026516 Department of the Navy, Washington, DC USA
Insulation Jacket for Breathing Gas Device
Hughes, Robert, Inventor; Haven, Lynn, Inventor; Courson, Billy, Inventor; Rudolph, Joseph, Inventor; Sep. 22, 1998; 7p; In English; Supersedes
Patent Info.: Filed 8 AUg. 96,
Report No.(s): AD-D019226; PAT,ALL-695,845; PAT-5,809,998; No Copyright; Avail: US Patent and Trademark Office, Microfiche

An insulation jacket is provided for a breathing gas device. A first jacket portion wraps completely about the device's cylinder and gas delivery valve. A second jacket portion wraps about a high-pressure regulator coupled in-tune with the gas delivery valve and a plurality of gas delivery conduits extending from the high-pressure regulator. The first and second jacket portions are formed

from a flexible insulating material of laminate construction. A plurality of fastening strips, e.g., hook-and-loop fastening strips, cooperate with first and second jacket portions after they are wrapped about the respective portions of the breathing gas device.
DTIC
Gas Flow; Laminates; Breathing Apparatus; Gas Mixtures

19990026639 Department of the Navy, Washington, DC USA
Self-Contained Oxygen Rebreather With Semi-Permeable Membrane to Vent Excess Helium
Gorin, Steve, Inventor; Jul. 14, 1998; 5p; In English; Supersedes US-Patent-Appl-SN-803207
Patent Info.: Filed 11 Feb. 97,; US-Patent-Appl-SN-803,207; US-Patent-5,778,876
Report No.(s): AD-D019258; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A self-contained underwater breathing loop apparatus for an oxygen rebreather includes a breathing bag formed to act as a compliant volume and a semipermeable membrane arranged to divide the breathing bag into a first chamber and a second chamber. A breathing hose is connected between a mouthpiece and the first chamber of the breathing bag to conduct exhaust breath from the diver thereto. The semipermeable membrane is formed to allow helium in the diver's exhaust breath to pass therethrough while preventing oxygen in the exhaust breath from being transported from the first chamber into the second chamber. A relief valve in the second chamber allows helium in the second chamber to be expelled into the water. A CO2 scrubber is in fluid communication with the first chamber of the breathing bag. A helium supply in fluid communication with the CO2 scrubber for supplying helium to the breathing loop through a metering valve. The helium supply preferably may be manually controlled by the diver to add helium in controlled amounts to the breathing loop to permit the diver to descend to a greater depth.
DTIC
Oxygen; Relief Valves; Breathing Apparatus; Helium

59
MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

19990026226 Department of Energy, Washington, DC USA
Numerical recipes for mold filling simulation
Kothe, D., Department of Energy, USA; Juric, D., Department of Energy, USA; Lam, K., Department of Energy, USA; Lally, B., Department of Energy, USA; Dec. 31, 1998; 18p; In English; 8th; Modeling of casting, welding and advanced solidification processes
Report No.(s): DE98-003467; LA-UR-98-214; CONF-980635; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Recent progress in algorithms for interface kinematics and dynamics, linear solution methods, computer science issues such as parallelization and object-oriented programming, high resolution Navier-Stokes (NS) solution methods, and unstructured mesh techniques, must all be pursued as possible paths toward higher fidelity mold filling simulations. A detailed exposition of these algorithmic developments is beyond the scope of this paper, hence the authors choose to focus exclusively on algorithms for interface kinematics. These interface tracking algorithms are designed to model the movement of interfaces relative to a reference frame such as a fixed mesh. Current interface tracking algorithm choices are numerous, so is any one best suited for mold filling simulation. Pros and cons are given. Highlighted are those outstanding interface tracking algorithm issues the authors feel can hamper the reliable modeling of today's foundry mold filling processes.
NTIS
Simulation; Molds; Numerical Analysis

60
COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware, and data processing. For components see 33 Electronics and Electrical Engineering.

19990025476 Infrared Components Corp., Utica, NY USA
Packaging and Cooling Considerations for Cryogenic Operation of Microprocessors ***Final Report***
Knauth, Jonathan P.; Penswick, Barry; Jan. 15, 1999; 50p; In English
Contract(s)/Grant(s): DABT63-97-C-0072
Report No.(s): AD-A359134; JK150199-01; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report contains a compilation of requirements and challenges for the cryogenic packaging of computer processors. A brief discussion of computer processing speed enhancements from sub-ambient cooling is included for use in cost/benefit analysis. A thermal analysis is presented which estimates the required cooling capacity needed for operation of microprocessors at sub-ambient temperatures over the range of from 40 deg C to 77 Kelvins. An analysis of electrical interconnection heat load is presented which concludes that this is the key challenge for the efficient design of sub-ambient computer systems, since reduction in heat load must be balanced with electrical impedance requirements, and the number of interconnections is quite large.
DTIC
Microprocessors; Cryogenics; Computer Techniques; Cost Effectiveness

19990026227 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA
Fault-tolerant computation with higher-dimensional systems
Gottesman, D., Department of Energy, USA; Dec. 31, 1998; 12p; In English; 1st; Quantum computing and quantum communications; Sponsored by NASA, USA
Report No.(s): DE98-003466; LA-UR-98-270; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Instead of a quantum computer where the fundamental units are 2-dimensional qubits, the author considers a quantum computer made up of d-dimensional systems. There is a straightforward generalization of the class of stabilizer codes to d-dimensional systems, and he discusses the theory of fault-tolerant computation using such codes. He proves that universal fault-tolerant computation is possible with any higher-dimensional stabilizer code for prime d.
NTIS
Fault Tolerance; Computation

61
COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM.

19990025222 Carnegie-Mellon Univ., Dept. of Computer Science, Pittsburgh, PA USA
The Fox Project: Advanced Development of Systems Software
Dec. 31, 1998; 5p; In English
Contract(s)/Grant(s): ARPA ORDER - 8313
Report No.(s): AD-A359273; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The long-term objectives of the Carnegie Mellon Fox Project are to improve the design and construction of systems software and to further the development of advanced programming language technology. We use principles and techniques from the mathematical foundations of programming languages, including semantics, type theory, and logic, to design and implement systems software, including operating systems, network protocols, and distributed systems. Much of the implementation work is conducted in the Standard ML (SML) language, a modern functional programming language that provides polymorphism, first-class functions, exception handling, garbage collection, a parameterized module system, static typing, and a formal semantics. This Project involves several faculty members and spans a wide range of research areas, from (I) advanced compiler development to (2) language design to (3) software system safety infrastructure.
DTIC
Software Engineering; Computer Programming; Computer Programs; Programming Languages; Logic Design; Computer Systems Programs

19990025258 Naval Postgraduate School, Monterey, CA USA

Fuel Inventory Manager - Development of Spreadsheet Models for Evaluating and Forecasting Inventory Positions and Net Inventories of Fuel for Navy Fuel Farms

Denman, Dane A.; Dec. 1998; 188p; In English

Report No.(s): AD-A359320; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

This thesis addresses the non-standardization of manual Navy fuel farm recordskeeping inventory procedures. It also addresses the errors in calculations and the man-hours required with current procedures. The errors in calculations lead to inventory inaccuracies which increase the possibility of the following: running out of fuel, spills due to overfilling or not being able to detect fuel loss due to leakage in a timely manner. A computerized spreadsheet using Microsoft Excel(TM) has been developed that will incorporate the formulas and tables used in these calculations in order to eliminate errors. A Users Guide was developed to familiarize the user with the versatility of Microsoft Excel(TM) to keep track of fuel inventories. This guide provides step-by-step instructions on how to construct the databases and models as discussed in the thesis. In summary, this thesis provides a quick accurate fuel inventory system. This system warrants the possibility of standardization throughout the Navy without an increase in government spending. Also, this system is simple, user-friendly and saves time. by reducing man-hours and labor, it also saves the government money. Information can be downloaded and e-mailed to higher commands as needed for strategic planning and allocation usage.

DTIC

Fuel Systems; Management Planning; Inventories; Data Bases; Forecasting; Computer Graphics; Tables (Data)

19990025328 OWL Display, Inc., Austin, TX USA

A Foveated Imaging System to Reduce Transmission Bandwidth of Video Images from Remote Camera Systems *Final Report, 30 Sep. 1994 - 30 Sep. 1998*

Geisler, Wilson S., OWL Display, Inc., USA; Webb, H. L., OWL Display, Inc., USA; Dec. 12, 1998; 33p; In English; Prepared in cooperation with Center for Vision and Image Science, Texas Univ., Austin, TX.

Contract(s)/Grant(s): F49620-94-C-0090

Report No.(s): AD-A359067; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This is the final progress report for a joint project between Geisler's laboratory at the University of Texas at Austin and OWL Displays. Inc., to develop a real time variable resolution (foveated) imaging system for video communications tasks such as remote control of unmanned vehicles. Although the OWL side of the project might best be described as a modest success, we believe the software and software/hardware integration performed at UT has been a big success. A general purpose real-time linkable library (for Pentium class computers running the Windows 95/98/NT OS) has been developed for coding and decoding variable resolution static images and video, both in 8-bit gray scale and 24-bit color. Real-time demonstration executables using the library are currently available at our web site for this project: http://fi.cvis.psv.utexas.edu. We have tested our real time software in conjunction with MPEG (H.263) and shown that it generally produces very substantial bandwidth savings both for I frames and P frames. We have also developed our own real time image compression library which includes fast motion compensation, fast pyramid coding, fast zero-tree coding and arithmetic coding. The foveated imaging software has been successfully interfaced and tested with a 512 x 512 8-bit b/w camera and two separate eye trackers: an ASL desktop heads-free eye tracker and the OWL/ASL V8 helmet mounted eye tracker.

DTIC

Bandwidth; Imaging Techniques; Image Processing; Video Signals; Cameras; Remote Control

19990025393 NASA Goddard Space Flight Center, Greenbelt, MD USA

Software Engineering Laboratory Series: Collected Software Engineering Papers, Volume 15

October 1997; 214p; In English; See also 19990025394 through 19990025405

Report No.(s): NASA/TM-1998-208614/VOL15; SEL-97-002/VOL15; NAS 1.15:208614/VOL15; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

The Software Engineering Laboratory (SEL) is an organization sponsored by NASA/GSFC and created to investigate the effectiveness of software engineering technologies when applied to the development of application software. The activities, findings, and recommendations of the SEL are recorded in the Software Engineering Laboratory Series, a continuing series of reports that includes this document.

Author

Computer Programming; Software Engineering; Software Reuse; Computer Programs

19990025394 CRIM, Montreal, Quebec Canada

Property-Based Software Engineering Measurement

Briand, Lionel C., CRIM, Canada; Morasca, Sandro, Politecnico di Milano, Italy; Basili, Victor R., Maryland Univ., USA; Software Engineering Laboratory Series: Collected Software Engineering Papers; October 1997; Volume 15, pp. 5-22; Repr. from IEEE Transactions on Software Engineering, v. 22, no. 1, Jan. 1996 p 68-85; In English; See also 19990025393

Contract(s)/Grant(s): NsG-5123; NSF 01-5-24845

Report No.(s): IEEE-LN-S95066; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Little theory exists in the field of software system measurement. Concepts such as complexity, coupling, cohesion or even size are very often subject to interpretation and appear to have inconsistent definitions in the literature. As a consequence, there is little guidance provided to the analyst attempting to define proper measures for specific problems. Many controversies in the literature are simply misunderstandings and stem from the fact that some people talk about different measurement concepts under the same label (complexity is the most common case). There is a need to define unambiguously the most important measurement concepts used in the measurement of software products. One way of doing so is to define precisely what mathematical properties characterize these concepts, regardless of the specific software artifacts to which these concepts are applied. Such a mathematical framework could generate a consensus in the software engineering community and provide a means for better communication among researchers, better guidelines for analysts, and better evaluation methods for commercial static analyzers for practitioners. In this paper, we propose a mathematical framework which is generic, because it is not specific to any particular software artifact and rigorous, because it is based on precise mathematical concepts. We use this framework to propose definitions of several important measurement concepts (size, length, complexity, cohesion, coupling). It does not intend to be complete or fully objective; other frameworks could have been proposed and different choices could have been made. However, we believe that the formalisms and properties we introduce are convenient and intuitive. This framework contributes constructively to a firmer theoretical ground of software measurement.

Author

Computer Programming; Computer Programs; Software Engineering; Software Reliability; Complexity; Cohesion; Coupling; Systems Engineering

19990025395 Maryland Univ., Inst. for Advanced Computer Studies, College Park, MD USA

A Validation of Object-Oriented Design Metrics as Quality Indicators

Basili, Victor R., Maryland Univ., USA; Briand, Lionel C., Fraunhofer-Inst. for Experimental Software Engineering, Germany; Melo, Walcelio, CRIM, Canada; Software Engineering Laboratory Series: Collected Software Engineering Papers; October 1997; Volume 15, pp. 23-33; Repr. from IEEE Transactions on Software Engineering, v. 22, no. 10, Oct. 1996 p 751-761; In English; See also 19990025393

Contract(s)/Grant(s): NsG-5123; NSF 01-5-24845

Report No.(s): IEEE-LN-S95819; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper presents the results of a study in which we empirically investigated the suits of object-oriented (00) design metrics introduced in another work. More specifically, our goal is to assess these metrics as predictors of fault-prone classes and, therefore, determine whether they can be used as early quality indicators. This study is complementary to the work described where the same suite of metrics had been used to assess frequencies of maintenance changes to classes. to perform our validation accurately, we collected data on the development of eight medium-sized information management systems based on identical requirements. All eight projects were developed using a sequential life cycle model, a well-known 00 analysis/design method and the C++ programming language. Based on empirical and quantitative analysis, the advantages and drawbacks of these 00 metrics are discussed. Several of Chidamber and Kamerer's 00 metrics appear to be useful to predict class fault-proneness during the early phases of the life-cycle. Also, on our data set, they are better predictors than 'traditional' code metrics, which can only be collected at a later phase of the software development processes.

Author

Computer Programming; Life (Durability); Object-Oriented Programming; Quantitative Analysis; Software Engineering

19990025396 Bell Telephone Labs., Inc., Software and Systems Research Lab., Murray Hill, NJ USA

Analytical and Empirical Evaluation of Software Reuse Metrics

Devanbu, Prem, Bell Telephone Labs., Inc., USA; Karstu, Sakke, Michigan Technological Univ., USA; Melo, Walcelio, Maryland Univ., USA; Thomas, William, Maryland Univ., USA; Software Engineering Laboratory Series: Collected Software Engineering Papers; October 1997; Volume 15, pp. 39-49; Repr. from Proceedings of the 18th International Conference on Software Engineering (ICSE-18), Mar. 1996 p 189-199; In English; 18th; Software Engineering, Unknown; See also 19990025393; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

How much can be saved by using existing software components when developing new software systems? With the increasing adoption of reuse methods and technologies, this question becomes critical. However, directly tracking the actual cost savings due to reuse is difficult. A worthy goal would be to develop a method of measuring the savings indirectly by analyzing the code for reuse of components. The focus of this paper is to evaluate how well several published software reuse metrics measure the ”time, money and quality” benefits of software reuse. We conduct this evaluation both analytically and empirically. On the analytic front, we constructed a toolset (using GEN++) to gather data on all published reuse metrics from C++ code; then, using some productivity and quality data from nearly replicated student projects at the University of Maryland, we evaluate the relationship between the known metrics and the process data. Our empirical study sheds some light on the applicability of our different analytic properties and has raised some practical issues to be addressed as we undertake broader study of reuse metrics in industrial projects.
Author
Computer Programs; Cost Reduction; Data Processing; Productivity; Software Engineering; Software Reuse; Modularity; Subroutine Libraries (Computers)

19990025397 Maryland Univ., Experimental Software Engineering Group, College Park, MD USA
Why Software Reliability Predictions Fail
Lanubile, Filippo, Maryland Univ., USA; Software Engineering Laboratory Series: Collected Software Engineering Papers; October 1997; Volume 15, pp. 51-53; Repr. from IEEE Software, 1996 p 131-132; In English; See also 19990025393; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

Software engineers have a great interest in applying measurement for predictive purposes. Most such studies focus on predicting early in the life cycle the reliability of software components. Because accurate prediction allows extra effort to be dedicated to inspecting and testing fault-prone components, its expected benefit is a more reliable product at a lower cost. Many predictive techniques are available, however. Discerning the real effectiveness of a particular technique, given the sometimes contradictory results presented by its advocates, require further study.
Derived from text
Computer Programs; Life (Durability); Predictions; Reliability Analysis; Software Reliability

19990025398 Maryland Univ., Dept. of Computer Science, College Park, MD USA
Defining Factors, Goals and Criteria for Reusable Component Evaluation
Kontio, Jyrki, Maryland Univ., USA; Caldiera, Gianluigi, Maryland Univ., USA; Basili, Victor R., Maryland Univ., USA; Software Engineering Laboratory Series: Collected Software Engineering Papers; October 1997; Volume 15, pp. 55-66; In English, 12-14 Nov. 1996, Toronto, Canada; See also 19990025393; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper presents an approach for defining evaluation criteria for reusable software components. We introduce a taxonomy of factors that influence selection, describe each of them, and present a hierarchical decomposition method for deriving reuse goals from factors and formulating the goals into an evaluation criteria hierarchy. We present some highlights from two case studies in which the approach was applied. The approach presented in this paper is a part of the Off-The-Shelf Option (OTSO) method that has been developed for reuseable component selection process.
Author
Computer Programs; Software Reuse; Modularity; Computer Systems Design; Software Development Tools

19990025399 Maryland Univ., Dept. of Computer Science, College Park, MD USA
Characterizing and Modeling the Cost of Rework in a Library of Reusable Software Components
Basili, Victor R., Maryland Univ., USA; Condon, Steven E., Computer Sciences Corp., USA; ElEmam, Khaled, Fraunhofer-Inst. for Experimental Software Engineering, Germany; Hendrick, Robert B., Computer Sciences Corp., USA; Melo, Walcelio, CRIM, Canada; Software Engineering Laboratory Series: Collected Software Engineering Papers; October 1997; Volume 15, pp. 69-78; Repr. from Proceedings of the 19th International Conference on Software Engineering (ICSE-19), May 1997 p 282-291; In English; 19th; Software Engineering, May 1997, Boston, MA, USA; See also 19990025393
Contract(s)/Grant(s): NAS5-31000; NASA-01-5-26393; NASw-1057; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

In this paper we characterize and model the cost of rework in a Component Factory (CF) organization. A CF is responsible for developing and packaging reusable software components. Data was collected on corrective maintenance activities for the Generalized Support Software reuse asset library located at the Flight Dynamics Division of NASA’s GSFC. We then constructed a predictive model of the cost of rework using the C4.5 system for generating a logical classification model. The predictor variables for the model are measures of internal software product attributes. The model demonstrates good prediction accuracy, and can

be used by managers to allocate resources for corrective maintenance activities. Furthermore, we used the model to generate proscriptive coding guidelines to improve programming, practices so that the cost of rework can be reduced in the future. The general approach we have used is applicable to other environments.
Author
Computer Programs; Software Reuse; Software Development Tools; Subroutines; Performance Prediction

19990025400 Cairo Univ., Engineering Mathematics Dept., Giza, Egypt
A Knowledge-Based Approach to the Analysis of Loops
Abd-El-Hafiz, Salwa K., Cairo Univ., Egypt; Basili, Victor R., Maryland Univ., USA; Software Engineering Laboratory Series: Collected Software Engineering Papers; October 1997; Volume 15, pp. 81-102; Repr. from IEEE Transactions on Software Engineering, v. 22, no. 5, May 1996 p 339-360; In English; See also 19990025393
Contract(s)/Grant(s): N00014-87-K-0307
Report No.(s): IEEE-LN-S95491; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper presents a knowledge-based analysis approach that generates first order predicate logic annotations of loops. A classification of loops according to their complexity levels is presented. Based on this taxonomy, variations on the basic analysis approach that best fit each of the different classes are described. In general, mechanical annotation of loops is performed by first decomposing them using data flow analysis. This decomposition encapsulates closely related statements in events, that can be analyzed individually. Specifications of the resulting loop events are then obtained by utilizing patterns, called plans, stored in a knowledge base. Finally, a consistent and rigorous functional abstraction of the whole loop is synthesized from the specifications of its individual events. to test the analysis techniques and to assess their effectiveness, a case study was performed on an existing program of reasonable size. Results concerning the analyzed loops and the plans designed for them are given.
Author
Predicate Logic; Reverse Engineering; Knowledge Based Systems; Computer Programs; Software Reuse

19990025401 Maryland Univ., Inst. for Advanced Computer Studies, College Park, MD USA
Experience from an Exploratory Case Study with a Software Risk Management Method, 1.00 ***Final Report***
Kontio, Jyrki, Maryland Univ., USA; Englund, Helena, Royal Inst. of Tech., Sweden; Basili, Victor R., Maryland Univ., USA; Software Engineering Laboratory Series: Collected Software Engineering Papers; October 1997; Volume 15, pp. 103-144; In English; See also 19990025393
Report No.(s): CS-TR-3705; UMIACS-TR-96-75; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper presents the results of an exploratory case study in which a risk management method was used and compared with a method currently used by the organization. The goal of the case study was to obtain feedback on an early version of a risk management method, called Riskit, that has been developed at the University of Maryland. This paper also presents an overview of Riskit method version 0.10 and describes the comparison method currently used by the case study organization, as well as the case study design.
Author
Management Methods; Computer Programs; Software Reliability; Reliability Analysis

19990025402 Maryland Univ., Inst. for Advanced Computer Studies, College Park, MD USA
An Empirical Study of Communication in Code Inspections
Seaman, Carolyn B., Maryland Univ., USA; Basili, Victor R., Maryland Univ., USA; Software Engineering Laboratory Series: Collected Software Engineering Papers; October 1997; Volume 15, pp. 145-155; Repr. from Proceedings of the 19th International Conference on Software Engineering (ICSE-19), 1997 p 96-106; In English; 19th; Software Engineering, 1997, Boston, MA, USA; See also 19990025393; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper describes an empirical study which addresses the issue of communication among members of a software development organization. In particular, data was collected concerning code inspections in one software development project. The question of interest is whether or not organizational structure (the network of relationships between developers) has an effect on the amount of effort expended on communication between developers. Both quantitative and qualitative methods were used, including participant observation, structured interviews, generation of hypotheses from field notes, some simple statistical tests of relationships, and interpretation of results with qualitative anecdotes. The study results show that past and present working relationships between inspection participants affect the amount of meeting time spent in different types of discussion, thus affecting the overall meeting length. Reporting relationships and physical proximity also have an effect, as well as the point in the project

that an inspection occurs. All but the last of these factors are organizational structure relationships. The contribution of the study is a set of well-supported hypotheses for further investigation.
Author
Computer Programming; Software Engineering; Program Verification (Computers); Programmers; Programming Environments; Systems Analysis; Checkout; Communication

19990025403 Maryland Univ., Inst. for Advanced Computer Studies, College Park, MD USA
How Reuse Influences Productivity in Object-Oriented Systems
Basili, Victor R., Maryland Univ., USA; Briand, Lionel C., Fraunhofer-Inst. for Experimental Software Engineering, Germany; Melo, Walcelio L., Centre de Recherche Informatique de Montreal, Canada; Software Engineering Laboratory Series: Collected Software Engineering Papers; October 1997; Volume 15, pp. 157-169; Repr. from Communications of the ACM, v. 39, no. 10, 1997 p 104-116; In English; See also 19990025393
Contract(s)/Grant(s): NsG-5123; NSF 01-5-24845; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Although reuse is assumed to be especially valuable in building high quality software as well as in Object Oriented (OO) development, limited empirical evidence connects reuse with productivity and quality gains. The author's eight system study begins to define such benefits in an OO framework, most notably in terms of reduce defect density and rework as well as in increased productivity.
Derived from text
Object-Oriented Programming; Productivity; Software Reuse; Computer Programs; Software Reliability

19990025404 NASA Goddard Space Flight Center, Greenbelt, MD USA
Using AppletMagic(tm) to Implement an Orbit Propagator: New Life for Ada Objects
Stark, Michael E., NASA Goddard Space Flight Center, USA; Software Engineering Laboratory Series: Collected Software Engineering Papers; October 1997; Volume 15, pp. 173-188; In English; See also 19990025393; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper will discuss the use of the Intermetrics AppletMagic tool to build an applet to display a satellite ground track on a world map. This applet is the result of a prototype project that was developed by the Goddard Space Flight Center's Flight Dynamics Division (FDD), starting in June of 1996. Both Version 1 and Version 2 of this applet can be accessed via the URL http://fdd.gsfc.nasa.gov/Java.html. This paper covers Version 1, as Version 2 did not make radical changes to the Ada part of the applet. This paper will briefly describe the design of the applet, discuss the issues that arose during development, and will conclude with lessons learned and future plans for the FDD's use of Ada and Java. The purpose of this paper is to show examples of a successful project using Oi AppletMagic, and to highlight some of the pitfalls that occurred along the way. It is hoped that this discussion will be useful both to users of AppletMagic and to organizations such as Intermetrics that develop new technology.
Derived from text
Ada (Programming Language); Java (Programming Language); Computer Programs; World Wide Web; Object-Oriented Programming

19990025405 NASA Goddard Space Flight Center, Greenbelt, MD USA
The Generalized Support Software (GSS) Domain Engineering Process: An Object-Oriented Implementation and Reuse Success at Goddard Space Flight Center
Condon, Steven, Computer Sciences Corp., USA; Hendrick, Robert, Computer Sciences Corp., USA; Stark, Michael E., NASA Goddard Space Flight Center, USA; Steger, Warren, Computer Sciences Corp., USA; Software Engineering Laboratory Series: Collected Software Engineering Papers; October 1997; Volume 15, pp. 189-195; In English; See also 19990025393; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The Flight Dynamics Division (FDD) of NASA's Goddard Space Flight Center (GSFC) recently embarked on a far-reaching revision of its process for developing and maintaining satellite support software. The new process relies on an object-oriented software development method supported by a domain specific library of generalized components. This Generalized Support Software (GSS) Domain Engineering Process is currently in use at the NASA GSFC Software Engineering Laboratory (SEL). The key facets of the GSS process are (1) an architecture for rapid deployment of FDD applications, (2) a reuse asset library for FDD classes, and (3) a paradigm shift from developing software to configuring software for mission support. This paper describes the GSS architecture and process, results of fielding the first applications, lessons learned, and future directions
Author
Computer Programming; Computer Programs; Object-Oriented Programming; Software Engineering; Software Reuse; Subroutine Libraries (Computers)

19990025567 Systems Engineering Associates, San Diego, CA USA
System Architecture for a Desktop Decision Trainer ***Final Report, Feb. 1992 - 1997***
VandeWetering, Brian; Garcia, Sharon K.; Dec. 1998; 13p; In English
Contract(s)/Grant(s): F33615-91-C-0007; AF Proj. 1123
Report No.(s): AD-A359246; AL/HR-TP-1997-0024; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper describes the software design of the Desktop Decision Training System (DDT). It documents how the systems software implements an instructional strategy to train complex decision-making skills to Logistics Command and Control (LC2) personnel. This paper is intended to be a pragmatic guide for the DDT's software programmers and technical management.
DTIC
Computer Systems Programs; Software Engineering; Decision Making

19990025576 Academy of Sciences of the Ukraine, Inst. of Cybernetics, Kiev, Ukraine
Development of Computer Methods for Prediction of New Materials Having Predefined Properties ***Final Report***
Gladun, Victor, Academy of Sciences of the Ukraine, Ukraine; Aug. 1995; 25p; In English
Report No.(s): AD-A358866; EOARD-SPC-95-4016; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report results from a contract tasking V. M. Glushkov Institute of Cybernetics, National Academy Sciences Ukraine as follows: a new approach to prediction of new material having predefined properties that is based on the method of artificial intelligence.
DTIC
Predictions; Cybernetics; Applications Programs (Computers)

19990025603 Joint Advanced Distributed Simulation Joint Test Force, Albuquerque, NM USA
Using High Level Architecture for Electronic Warfare Test and Evaluation
Nov. 1998; 15p; In English
Report No.(s): AD-A359338; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Joint Advanced Distributed Simulation (JADS) Joint Test Force (JTF) was chartered by the Office of the Secretary of Defense (Acquisition and Technology) to investigate the utility of Advanced Distributed Simulation (ADS) technology, including the High Level Architecture (HLA), for use in Test and Evaluation (T&E). to accomplish this, the High Level Architecture (HLA) and a Run Time Infrastructure (RTI) are being used by JADS to perform test and evaluation of an electronic warfare self protection jammer (SPJ). The Electronic Warfare (EW) test is collecting SPJ performance data in three different phases of system development and test. The three JADS EW test phases are: a linked test of an EW Digital System Model, a linked test of a SPJ in an Installed System Test Facility, and an Open Air Range flight test. The linked tests will employ an ADS test architecture, including the HLA, for evaluating representations of the EW system under test (SUT) early in the system design phase and late in the development phase. For the linked tests, JADS will use a distributed network of facilities across the USA. The emphasis of the JADS EW test is on the performance of the ADS components and their benefit, if any, to EW T&E, rather than on any particular EW system under test or class of systems. The JADS EW linked tests are designed to evaluate issues associated with distributed testing, network performance, and their relationship to EW performance data collected. This paper provides JADS experience to date in applying Defense Modeling and Simulation Organization's (DMSO) HLA in the JADS EW test. The process used by JADS to design the EW test, characterize network latencies, the RTI performance measurements made in the JADS test bed, and how that characterization will be applied to the JADS federation are provided.
DTIC
Characterization; Data Acquisition; Digital Systems; Electronic Warfare; Flight Tests; Simulation

19990025604 Joint Advanced Distributed Simulation Joint Test Force, Albuquerque, NM USA
The Benefits of Using Advanced Distributed Simulation for Air- to -Air Missile Test and Evaluation
McKee, Larry; Nov. 1998; 11p; In English
Report No.(s): AD-A359339; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Joint Advanced Distributed Simulation (JADS) Joint Test and Evaluation (JT&E) was chartered by the Office of the Secretary of Defense (Acquisition and Technology) in October 1994 to investigate the utility of advanced distributed simulation (ADS) technologies for support of test and evaluation (T&E). The JADS Joint Test Force (JTF) conducted a System Integration Test (SIT) in which ADS was used to support the testing of an integrated missile weapon/launch aircraft system in operationally realistic scenarios. The SIT scenarios simulated a single shooter aircraft launching an air-to-air missile against a single target aircraft. Extensive testing was performed involving two different ADS architectures: (1) A linked laboratory configuration in which the shooter and target were represented by manned flight laboratories and the missile by an AIM-9M Sidewinder hardware-in-the-

loop (HWIL) laboratory. (2) A live shooter/target configuration in which the shooter and target were represented by live F-16 fighters and the missile by an AIM-120 Advanced Medium Range Air-to-Air Missile (AMRAAM) HWIL laboratory. Testing was completed in October 1997, and evaluation of the results Supports the conclusion that each ADS configuration has utility for T&E of the corresponding air-to-air missile involved. This paper discusses the following: (1) Description of the two different architectures utilized in the SIT testing. (2) Technical challenges in implementing ADS. (3) Lessons learned from implementing ADS. (4) Conclusions on the utility of ADS-based testing of air-to-air missiles. (5) Benefits of implementing AD S-based testing of air-to-air missiles.
DTIC
Systems Integration; Targets; Missile Tests; Missile Systems; F-16 Aircraft

19990025640 UK Atomic Energy Authority, Abingdon, UK
3-D Body-Fitted Software on the MHPCC SP2 Computer ***Final Report***
Eastwood, James W., UK Atomic Energy Authority, UK; Arter, W., UK Atomic Energy Authority, UK; Brealey, N. J., UK Atomic Energy Authority, UK; Hockney, R. W., UK Atomic Energy Authority, UK; Sep. 1995; 243p; In English
Contract(s)/Grant(s): F61708-95-C-0010
Report No.(s): AD-A358920; AEA/TYKB/28O06/RP/1; EOARD-SPC-95-4019; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

This report results from a contract tasking Culham Laboratory, UKAEA as follows: write software and datasets for a SUN workstation at Phillips Laboratory and on Maui High Performance Computer Center SP2 computer.
DTIC
Computers; Workstations; Computer Systems Performance

19990025771 Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA
Hughes Aircraft's Widespread Deployment of a Continuously Improving Software Process ***Final Report***
Willis, R. R.; Rova, R. M.; Scott, M. D.; Johnson, M. I.; Ryskowski, J. F.; May 1998; 101p; In English; Supersedes , AD-A353168.
Contract(s)/Grant(s): F19628-95-C-0003
Report No.(s): AD-A358993; CMU/SEI-98-TR-006; ESC*-TR-98-006; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This report describes the software improvement activities of Hughes Aircraft Company over the last 25 years. The focus is on continuous improvement of the software development process and the deployment of that process from a single organization at Fullerton, California, to virtually all the 5000 software engineers of Hughes Aircraft. For this achievement, the widespread deployment of a continuously improving software process, Hughes Aircraft was awarded the 1997 IEEE Computer Society Software Process Achievement Award.
DTIC
Computer Programming; Computer Programs; Deployment

19990025789 NASA Goddard Space Flight Center, Greenbelt, MD USA
Software Engineering Laboratory Series: Proceedings of the Twenty-Second Annual Software Engineering Workshop
Dec. 1997; 540p; In English; 22nd; Software Engineering, 3-4 Dec. 1997, Greenbelt, MD, USA; Sponsored by NASA Goddard Space Flight Center, USA; See also 19990025790 through 19990025811
Report No.(s): NASA/TM-1998-208618; SEL-97-003; NAS 1.15:208618; No Copyright; Avail: CASI; A23, Hardcopy; A04, Microfiche

The Software Engineering Laboratory (SEL) is an organization sponsored by NASA/GSFC and created to investigate the effectiveness of software engineering technologies when applied to the development of application software. The activities, findings, and recommendations of the SEL are recorded in the Software Engineering Laboratory Series, a continuing series of reports that includes this document.
Author
Conferences; Software Engineering; Computer Programming

19990025790 NASA Goddard Space Flight Center, Greenbelt, MD USA
The SEL Adapts to Meet Changing Times
Pajerski, Rose S., NASA Goddard Space Flight Center, USA; Basili, Victor R., Maryland Univ., USA; Software Engineering Laboratory Series: Proceedings of the Twenty-First Annual Software Engineering Workshop; Dec. 1997, pp. 3-19; In English; See also 19990025789; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Since 1976, the Software Engineering Laboratory (SEL) has been dedicated to understanding and improving the way in which one NASA organization, the Flight Dynamics Division (FDD) at Goddard Space Flight Center, develops, maintains, and manages complex flight dynamics systems. It has done this by developing and refining a continual process improvement approach that allows an organization such as the FDD to fine-tune its process for its particular domain. Experimental software engineering and measurement play a significant role in this approach. The SEL is a partnership of NASA Goddard, its major software contractor, Computer Sciences Corporation (CSC), and the University of Maryland's (LTM) Department of Computer Science. The FDD primarily builds software systems that provide ground-based flight dynamics support for scientific satellites. They fall into two sets: ground systems and simulators. Ground systems are midsize systems that average around 250 thousand source lines of code (KSLOC). Ground system development projects typically last 1 - 2 years. Recent systems have been rehosted to workstations from IBM mainframes, and also contain significant new subsystems written in C and C++. The simulators are smaller systems averaging around 60 KSLOC that provide the test data for the ground systems. Simulator development lasts up to 1 year. Most of the simulators have been built in Ada on workstations. The SEL is responsible for the management and continual improvement of the software engineering processes used on these FDD projects.
Derived from text
Complex Systems; Computer Programs; Computer Systems Programs; Simulators; Software Engineering; Systems Engineering; Systems Analysis; Subroutine Libraries (Computers)

19990025791 NASA Goddard Space Flight Center, Greenbelt, MD USA
The Package-Based Development Process in the Flight Dynamics Division
Parra, Amalia, Computer Sciences Corp., USA; Seaman, Carolyn, Maryland Univ., USA; Basili, Victor, Maryland Univ., USA; Kraft, Stephen, NASA Goddard Space Flight Center, USA; Condon, Steven, Computer Sciences Corp., USA; Burke, Steven, Computer Sciences Corp., USA; Yakimovich, Daniil, Maryland Univ., USA; Software Engineering Laboratory Series: Proceedings of the Twenty-First Annual Software Engineering Workshop; Dec. 1997, pp. 21-55; In English; See also 19990025789; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The Software Engineering Laboratory (SEL) has been operating for more than two decades in the Flight Dynamics Division (FDD) and has adapted to the constant movement of the software development environment. The SEL's Improvement Paradigm shows that process improvement is an iterative process. Understanding, Assessing and Packaging are the three steps that are followed in this cyclical paradigm. As the improvement process cycles back to the first step, after having packaged some experience, the level of understanding will be greater. In the past, products resulting from the packaging step have been large process documents, guidebooks, and training programs. As the technical world moves toward more modularized software, we have made a move toward more modularized software development process documentation, as such the products of the packaging step are becoming smaller and more frequent. In this manner, the QIP takes on a more spiral approach rather than a waterfall. This paper describes the state of the FDD in the area of software development processes, as revealed through the understanding and assessing activities conducted by the COTS study team. The insights presented include: (1) a characterization of a typical FDD Commercial Off the Shelf (COTS) intensive software development life-cycle process, (2) lessons learned through the COTS study interviews, and (3) a description of changes in the SEL due to the changing and accelerating nature of software development in the FDD.
Author
Computer Programming; Software Engineering; Computer Systems Design; Modularity; Software Reuse; Object-Oriented Programming; Improvement; Software Development Tools; Productivity

19990025792 Maryland Univ., Dept. of Computer Science, College Park, MD USA
The Web Measurement Environment (WebME): A Tool for Combining and Modeling Distributed Data
Tesoriero, Roseanne, Maryland Univ., USA; Zelkowitz, Marvin, Maryland Univ., USA; Software Engineering Laboratory Series: Proceedings of the Twenty-First Annual Software Engineering Workshop; Dec. 1997, pp. 57-77; In English; See also 19990025789
Contract(s)/Grant(s): NCC5-170; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Many organizations have incorporated data collection into their software processes for the purpose of process improvement. However, in order to improve, interpreting the data is just as important as the collection of data. With the increased presence of the Internet and the ubiquity of the World Wide Web, the potential for software processes being distributed among several physically separated locations has also grown. Because project data may be stored in multiple locations and in differing formats, obtaining and interpreting data from this type of environment becomes even more complicated. The Web Measurement Environment (WebME), a Web-based data visualization tool, is being developed to facilitate the understanding of collected data in a distributed

environment. The WebME system will permit the analysis of development data in distributed, heterogeneous environments. This paper provides an overview of the system and its capabilities.
Author
World Wide Web; Software Development Tools; Software Engineering; Programming Environments; Measurement; Computer Programming

19990025793 Computer Sciences Corp., Lanham, MD USA
Calibration of a COTS Integration Cost Model Using Local Project Data
Boland, Dillard, Computer Sciences Corp., USA; Coon, Richard, Computer Sciences Corp., USA; Byers, Kathryn, Computer Sciences Corp., USA; Levitt, David, Computer Sciences Corp., USA; Software Engineering Laboratory Series: Proceedings of the Twenty-second Annual Software Engineering Workshop; Dec. 1997, pp. 81-98; In English; See also 19990025789; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The software measures and estimation techniques appropriate to a Commercial Off the Shelf (COTS) integration project differ from those commonly used for custom software development. Labor and schedule estimation tools that model COTS integration are available. Like all estimation tools, they must be calibrated with the organization's local project data. This paper describes the calibration of a commercial model using data collected by the Flight Dynamics Division (FDD) of the NASA Goddard Spaceflight Center (GSFC). The model calibrated is SLIM Release 4.0 from Quantitative Software Management (QSM). By adopting the SLIM reuse model and by treating configuration parameters as lines of code, we were able to establish a consistent calibration for COTS integration projects. The paper summarizes the metrics, the calibration process and results, and the validation of the calibration.
Author
Computer Programming; Cost Analysis; Mathematical Models; Software Engineering; Software Reuse; Computer Programs; Calibrating

19990025794 National Research Council of Canada, Inst. for Information Technology, Ottawa, Ontario Canada
An Architectural Approach to Building Systems from COTS Software Components
Vigder, Mark R., National Research Council of Canada, Canada; Dean, John, National Research Council of Canada, Canada; Software Engineering Laboratory Series: Proceedings of the Twenty-Second Annual Software Engineering Workshop; Dec. 1997, pp. 99-131; In English; See also 19990025789
Report No.(s): NRC-40221; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

As software systems become increasingly complex to build developers are turning more and more to integrating pre-built components from third party developers into their systems. This use of Commercial Off-The-Shelf (COTS) software components in system construction presents new challenges to system architects and designers. This paper is an experience report that describes issues raised when integrating COTS components, outlines strategies for integration, and presents some informal rules we have developed that ease the development and maintenance of such systems.
Author
Computer Programs; Computer Systems Programs; Software Engineering; Computer Systems Design; Software Reliability; Software Reuse; Modularity; Client Server Systems

19990025795 TRW, Inc., Fairfax, VA USA
A Software Development Process for COTS-Based Information System Infrastructure
Fox, Greg, TRW, Inc., USA; Lantner, Karen, EDS Corp., USA; Marcom, Steven, TRW, Inc., USA; Software Engineering Laboratory Series: Proceedings of the Twenty-Second Annual Software Engineering Workshop; Dec. 1997, pp. 133-153; In English; See also 19990025789; ISBN 0-8186-7940-9; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Modern software developers are guided by a variety of formal and informal processes that organize and control development activities across large groups of developers or multiple organizations and supply discipline and order lacking in many early development efforts. The available inventory of documented process methods is limited: Most process methods assume the system being built will be coded largely from scratch. The processes do not address many of the challenges associated with building systems that contain large amounts of commercial off-the-shelf (COTS) software. The Infrastructure Incremental Development Approach (IIDA) is a combination of the classical development model and the spiral process model to accommodate the needs of COTS-based technical infrastructure development.
Author
Computer Programming; Software Engineering; Software Reuse; Software Reliability; Life Cycle Costs; Computer Systems Design; Systems Analysis

19990025796 Computer Sciences Corp., System Engineering and Analysis Support Center, Greenbelt, MD USA

Experiences with CMM and ISO 9001 Benchmarks

Haskell, Joe, Computer Sciences Corp., USA; Decker, William, Computer Sciences Corp., USA; McGarry, Frank, Computer Sciences Corp., USA; Software Engineering Laboratory Series: Proceedings of the Twenty-Second Annual Software Engineering Workshop; Dec. 1997, pp. 157-176; In English; See also 19990025789; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The use of industry benchmarks to measure process maturity and process compliance has increased significantly in recent years. Two widely applied benchmarks are the Software Engineering Institute's (SEI's) Capability Maturity Model (CMM) and a set of quality standards developed by the International Standards Organization (ISO). Although there is disagreement regarding the value and application of these benchmarks, many Government organizations use them to identify and select qualified contractors. Thus, it is becoming increasingly important for suppliers of products and services to become ISO registered and CMM compliant to satisfy criteria stipulated by potential customers. CSC's SEAS Center attained ISO 9001 registration in May 1997. In November 1997, the SEAS Center was rated at CMM Level 3 based on a Software Capability Evaluation (SCE), with several Level 4-5 key process areas (KPAs) also satisfied. Information regarding the activities and effort to attain ISO registration and CMM Level 3 compliance was collected from SEAS Center participants. Also collected was participants' opinions regarding the impact that pursuit of each benchmark had on the organization. This information served as a basis for determining (1) the SEAS Center resources required to attain ISO registration and CM Level 3 compliance and (2) the impact that pursuit of each of these industry benchmarks had on improving the SEAS Center's ability to deliver high-quality products and services to its customers. This paper documents the experiences of the SEAS Center in pursuing CMM compliance and ISO 9001 registration. It is based entirely on information collected from SEAS Center personnel who planned and participated in the successful ISO 9001 registration and SCE efforts. Other organizations contemplating an SCE and/or ISO registration should find the experiences of the SEAS Center useful in planning their effort.

Author

Computer Programming; Software Engineering; Standards; Standardization; Quality Control; Software Reliability

19990025797 Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA

Using PSP and TSP Data to Manage Software Quality

Humphrey, Watts S., Carnegie-Mellon Univ., USA; Software Engineering Laboratory Series: Proceedings of the Twenty-Second Annual Software Engineering Workshop; Dec. 1997, pp. 177-192; In English; See also 19990025789; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

In this paper, I briefly describe the Personal Software Process (PSP) and Team Software Process (TSP). I then discuss the PSP/TSP quality strategy and show PSP data that demonstrate the logic for this strategy. Finally, I show preliminary data on how this strategy works in practice.

Author

Software Reliability; Software Engineering; Program Verification (Computers); Computer Program Integrity; Computer Programs

19990025798 Computer Sciences Corp., System Engineering and Analysis Support Center, Greenbelt, MD USA

Measuring Impacts of Software Process Maturity in a Production Environment

McGarry, Frank, Computer Sciences Corp., USA; Burke, Steve, Computer Sciences Corp., USA; Decker, Bill, Computer Sciences Corp., USA; Software Engineering Laboratory Series: Proceedings of the Twenty-Second Annual Software Engineering Workshop; Dec. 1997, pp. 193-220; In English; See also 19990025789; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

For over 20 years, the System Engineering and Analysis Support (SEAS) Center has been supporting NASA in the development of Mission Operations and Data Systems software. During that time, there have been numerous studies and activities designed to measure and analyze the quality of software products as well as the technologies and processes used to produce those products. This paper describes the approach, activities, data, and early results of studies attempting to more generally determine the impact that software processes have on the end item software products. The paper describes the approach to identifying project data for both the product and process and describes one aspect of the series of studies being carried out; the results of analyzing the relationship between project quality and the corresponding process ratings as defined by the Software Engineering Institute (SEI) in their Capability Maturity Model (CMM). The studies have taken place within CSC/SEAS Center where software systems are developed and maintained in support of NASA flight projects. The projects have ranged in size from 10 KDSI (thousand delivered source instructions) to over 700 KDSI and the applications have specifically been for mission support activities; which include systems for control center operations, data processing activities, command and control and flight dynamics disciplines.

In order to carry out this analysis, over 90 software projects were analyzed where information was available characterizing both the end software product as well as the methods and general processes used to produce that product. Defect data, effort, cycle time, and size were some of the product measures examined. CMM Key Process Area (KPA) ratings from Software Capability Evaluations (SCES) and Software Process Assessments (SPAs), In-Progress Process Audits (IPPAs), Flight Dynamics Subjective Evaluation Forms (SEFs), and project history reports were some of the measures and information examined representing the process of the software. This particular study analyzed the potential impact that the CMM Maturity Level 2 and 3 KPAs had on product defect rates, productivity, cycle time, and effort variance. Also analyzed was how these four product measures changed over time. The study showed: (1) There was not a significant correlation between quantified process maturity and the four product measures (for those projects with detailed CMM scores); (2) Software productivity and software defect rates improved consistently over the 14 year period; independent of software process activities based on CMM improvements; (3) Software development cycle time and software effort estimation improved significantly for the SEAS Center after the start of process improvement activities based on CMM (for 1 class of systems).
Author
Computer Systems Programs; Productivity; Project Management; Software Reliability; Software Engineering; Programming Environments

19990025799 Westinghouse Electric Corp., Commercial Nuclear Fuel Div., Pittsburgh, PA USA
A Time-Based Management Approach to Software Process Improvement
Beard, Charlie L., Westinghouse Electric Corp., USA; Paesano, Patty C., Westinghouse Electric Corp., USA; Savage, Chris R., Westinghouse Electric Corp., USA; Software Engineering Laboratory Series: Proceedings of the Twenty-Second Annual Software Engineering Workshop; Dec. 1997, pp. 221-247; In English; See also 19990025789; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The software Capability Maturity Model is built upon the framework of Total Quality Management (TQM). In many cases, the application of TQM principles results in cycle-time reduction as a side benefit of the process and quality improvements. TQM originated in manufacturing, and the evolution of TQM in the manufacturing world has been Time-Based Management (TBM). TBM deals with a change of perspective, from a focus on the quality of products to a focus on cycle time reduction, while still maintaining high standards of quality. TBM provides a very straightforward metric, cycle time, which allows one to measure the process from a different perspective. by focusing on cycle-time reduction, while still maintaining a TQM foundation, significant improvements in the process can be realized. Also, it has been demonstrated that cycle-time reduction is an important factor in achieving a competitive advantage. This paper demonstrates how we took the models for TBM in the manufacturing area and adapted them for use in a white collar software ”factory”. It explains the basic concepts, ties them into the Capability Maturity Model, and provides some feedback on our experience.
Author
Computer Programs; Total Quality Management; Management Methods; Production Management; Life Cycle Costs; Software Engineering; Software Reliability

19990025800 University of Southern California, Center for Software Engineering, Los Angeles, CA USA
Calibrating the COCOMO II Post-Architecture Model
Devnani-Chulani, Sunita, University of Southern California, USA; Clark, Bradford, University of Southern California, USA; Boehm, Barry, University of Southern California, USA; Software Engineering Laboratory Series: Proceedings of the Twenty-Second Annual Software Engineering Workshop; Dec. 1997, pp. 249-267; In English; See also 19990025789; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The COCOMO II model was created to meet the need for a cost model that accounted for future software development practices. This resulted in the formulation of three submodels for cost estimation, one for composing applications, one for early lifecycle estimation and one for detailed estimation when the architecture of the product is understood. This paper describes the calibration procedures for the last model, Post-Architecture COCOMO II model, from eighty-three observations. The results of the multiple regression analysis and their implications are discussed. Future work includes further analysis of the Post-Architecture model, calibration of the other models, derivation of maintenance parameters, and refining the effort distribution for the model output.
Author
Calibrating; Computer Programming; Cost Analysis; Cost Estimates; Software Engineering; Life Cycle Costs; Delphi Method (Forecasting); Regression Analysis; Models

19990025801 Reifer Consultants, Inc., Torrance, CA USA

Assessing the Accuracy of the COCOMO II.1997 Estimating Model

Reifer, Donald J., Reifer Consultants, Inc., USA; Software Engineering Laboratory Series: Proceedings of the Twenty-Second Annual Software Engineering Workshop; Dec. 1997, pp. 269-281; In English; See also 19990025789; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The COCOMO II.1997 software cost model recently made its debut from the University of Southern California. This new version of the popular estimating package popularized by Dr. Barry Boehm has been redefined to incorporate many state-of-the-art features and capabilities aimed at making it usable well into the 21st century. While designed for upward compatibility, the model differs from its predecessor in both structure and mathematical formulation. For example, it uses five scale factors instead of three modes to compute the power law to which the base equation in the model is raised based upon function points or a software line of code size metric. As another example, it computes its effort multiplier from the model's base equation using 17 cost drivers, 3 of which are new to the model. The goal of this presentation is to summarize a detailed analysis conducted to assess the estimating accuracy of the COCOMO II.1997 model. to accomplish this goal, we converted 91 existing estimates made with the previous version of the model using the Rosetta stone that was developed for that purpose. The Rosetta stone provides its user with guidance on how to rate scale factors and cost drivers as estimates are converted from the COMOCO 81 to COCOMO II.1997 model or vice versa. The estimates using both models were then compared to each other and the actuals realized for 89 of the projects in the database. The other 2 data points were eliminated because they represented outliers that were not significant. Results were then analyzed further using statistical methods to determine whether they were correlated or if there were co-linearity. The presentation will assume that participants at the 22nd Annual Software Engineering Workshop know nothing about the COCOMO II-1997 model. It will start by briefly summarizing its features and how it differs from the original COCOMO. The presentation will then switch gears and discuss the accuracy analysis. It will highlight the approach taken and the results achieved. The presentation will conclude with a discussion of what the results mean. It will talk what features of the model seem to work based upon the data and where caution needs to be exercised because validity can not be determined. Finally, the presentation will make a plea for more data. The COCOMO team needs it to firm up their calibration and make the model which is publically available for free from the USC Center for Software Engineering web site more valid across a wider spectrum of applications domains. Author

Computer Programming; Cost Analysis; Estimating; Mathematical Models; Software Engineering; Statistical Analysis; Life Cycle Costs

19990025802 Alabama Univ., Dept. of Computer Science, Tuscaloosa, AL USA

Component Based Software Development: Parameters Influencing Cost Estimation

Smith, Randy K., Alabama Univ., USA; Parrish, Allen, Alabama Univ., USA; Hale, Joanne, Alabama Univ., USA; Software Engineering Laboratory Series: Proceedings of the Twenty-Second Annual Software Engineering Workshop; Dec. 1997, pp. 283-300; In English; See also 19990025789

Contract(s)/Grant(s): NSF CDA-97-12929; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Traditional software development is characterized by the structured programming paradigm introduced in the late 60's and early 70's. This paradigm relies on top-down functional decomposition to derive software modules. The structured programming paradigm provides, a monolithic view of the software development process. Traditional software cost estimation models capture this monolithic view of software development. In these models, software cost is projected at the large-grained system level. Contemporary development practices characterize a software application as interacting, independent components. These components may be Commercial-Off-The-Shelf (COTS) components, internally developed reusable components or newly developed software artifacts. To accurately predict effort in Component Based Software Development (CBSD), a fine-grained approach is needed to identify and classify the relevant cost factors. In recognition of the shift in development practice, monolithic cost estimation models have been adapted and refined to capture cost estimates for each component in an application. While such adaptations are useful, they do not capture all of the factors that could potentially impact component-based development. Section 2 demonstrates the application of a monolithic cost model (COCOMO) to CBSD. Section 3 identifies important metrics associated with CBSD. Section 4 discusses a preliminary study in which two of the CBSD metrics are used to augment the COCOMO model to produce a more accurate estimate for the project in the study. The conclusion section discusses the impact of these results and outlines additional work to be completed.

Author

Computer Programming; Computer Programs; Cost Analysis; Cost Estimates; Mathematical Models; Software Engineering; Structured Programming; Programmers

19990025803 Manitoba Univ., Dept. of Computer Science, Winnipeg, Manitoba Canada

A Verifier for Object-Oriented Designs

Periyasamy, K., Manitoba Univ., Canada; Baluta, W., Manitoba Univ., Canada; Software Engineering Laboratory Series: Proceedings of the Twenty-Second Annual Software Engineering Workshop; Dec. 1997, pp. 303-336; In English; See also 19990025789; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Many object-oriented design methods such as Rumbaugh's, Booch's and Coad-Yourdon's methods use graphical notations which enable a software designer to describe a design more precisely and in an easily comprehensible manner. Tools supporting such object-oriented design methods generally provide a graphical user interface (GUI). The GUI will display a list of symbols corresponding to object-oriented design primitives and a working area. A designer using such a tool will develop object-oriented designs by selecting appropriate symbols from those provided by the GUI and by connecting them in a meaningful way. One of the problems with existing tools for object-oriented design methods is that they merely act as drawing tools with minimal syntactic checking. For example, OMTool which implements Rumbaugh's method, ensures that no two classes in a single class diagram have the same name. However, it is possible to develop a design diagram using OMTool in which two classes, A and B, inherit each other (i.e., A inherits B and B inherits A). Such cyclic inheritance is semantically invalid according to principles of object-orientation. A possible remedy for these problems is to embed verification strategies in the tool itself. This process requires the development of formal semantics of the modeling notations used by the tool. In this paper, we describe an axiomatic semantics for the modeling notations used by the Object Modeling Technique (OMT) proposed by Rumbaugh and others. We also describe the features of a verifier which implements the semantics. The modeling notations for which we have developed the formal semantics include class structure, its components (such as attributes and operations), relationships among classes (such as association and aggregation), object states, transitions between states and events. Most of these notations are also available in the Unified Modeling Language (UML), which is emerging as the industry-standard for object-oriented analysis and design. We have used the Z formal notation to develop the semantics; the specification has been type-checked using the fuzz type checker. The implementation of the semantics was carried out using a rule-based approach; we used the tool CLIPS, an industrially approved tool for developing knowledge-base systems for this purpose. The axioms in Z have been implemented as rules in CLIPS. All the rules have been constructed using templates with slots for generic parameters. When verifying a particular design, the design elements are substituted for the parameters of appropriate rules and the rules are fired. Currently, we use a temporary format for input to the verifier. It is part of our future work to integrate the verifier with the Rational Rose tool so that the verifier accepts input of the same format as that of Rational Rose. Current version of Rational Rose (Rose 4.0) is intended for developing object-oriented designs using UML. The rest of the paper is organized as follows: Section 2 describes the axiomatic semantics of OMT in Z. This includes the specification of object model and dynamic model. We describe the implementation of the semantics in Section 3. The paper concludes in Section 4 with comments on continuing work.
Derived from text

Graphical User Interface; Object-Oriented Programming; Semantics; Software Engineering; Structured Programming; Computer Systems Design

19990025804 Washington Univ., Seattle, WA USA

Demonstration of a Safety Analysis on a Complex System

Leveson, Nancy, Washington Univ., USA; Alfaro, Liliana, Washington Univ., USA; Alvarado, Christine, Dartmouth Coll., USA; Brown, Molly, Washington Univ., USA; Hunt, Earl B., Washington Univ., USA; Jaffe, Matt, Embry-Riddle Aeronautical Univ., USA; Joslyn, Susan, Washington Univ., USA; Pinnell, Denise, Washington Univ., USA; Reese, Jon, Washington Univ., USA; Samarziya, Jeffrey, Washington Univ., USA; Sandys, Sean, Washington Univ., USA; Shaw, Alan, Washington Univ., USA; Zabinsky, Zelda, Washington Univ., USA; Software Engineering Laboratory Series: Proceedings of the Twenty-Second Annual Software Engineering Workshop; Dec. 1997, pp. 337-352; In English; See also 19990025789; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

For the past 17 years, Professor Leveson and her graduate students have been developing a theoretical foundation for safety in complex systems and building a methodology upon that foundation. The methodology includes special management structures and procedures, system hazard analyses, software hazard analysis, requirements modeling and analysis for completeness and safety, special software design techniques including the design of human-machine interaction, verification, operational feedback, and change analysis. The Safeware methodology is based on system safety techniques that are extended to deal with software and human error. Automation is used to enhance our ability to cope with complex systems. Identification, classification, and evaluation of hazards is done using modeling and analysis. to be effective, the models and analysis tools must consider the hardware, software, and human components in these systems. They also need to include a variety of analysis techniques and orthogonal approaches: There exists no single safety analysis or evaluation technique that can handle all aspects of complex systems. Applying only one or two may make us feel satisfied, but will produce limited results. We report here on a demonstration, performed as part of a

contract with NASA Langley Research Center, of the Safeware methodology on the Center-TRACON Automation System (CTAS) portion of the air traffic control (ATC) system and procedures currently employed at the Dallas/Fort Worth (DFW) TRACON (Terminal Radar Approach CONtrol). CTAS is an automated system to assist controllers in handling arrival traffic in the DFW area. Safety is a system property, not a component property, so our safety analysis considers the entire system and not simply the automated components. Because safety analysis of a complex system is an interdisciplinary effort, our team included system engineers, software engineers, human factors experts, and cognitive psychologists.
Derived from text
Complex Systems; Computer Programs; Safety Factors; Software Engineering; Systems Engineering; Reliability Engineering; Systems Analysis

19990025805 Indian Inst. of Tech., Dept. of Computer Science and Engineering, Kanpur, India
Automatic Generation of Test Coverage Analyzers
Aggarwal, Sanjeev, Indian Inst. of Tech., India; Bhattacharyya, Utpal, Indian Inst. of Tech., India; Software Engineering Laboratory Series: Proceedings of the Twenty-Second Annual Software Engineering Workshop; Dec. 1997, pp. 353-367; In English; See also 19990025789; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Software Test Coverage Analyzers are very useful in software testing processes. The development of Test Coverage Analyzers is a labor-intensive and time consuming process. This paper describes a generative approach for development of Test Coverage Analyzers, which can generate test coverage analyzers for a language, given the grammar and probe specification. Application experiences have shown that, a 150 lines (approximately) specification is enough for generating a Test Coverage Analyzer; and the productivity gain is as much as 25-35 times of the hand coded development.
Author
Productivity; Program Verification (Computers); Software Engineering; Software Reliability; Software Development Tools; Computer Programming; Checkout

19990025806 Naval Postgraduate School, Monterey, CA USA
Measuring and Evaluating the Stability of Maintenance Processes
Schneidewind, Norman F., Naval Postgraduate School, USA; Software Engineering Laboratory Series: Proceedings of the Twenty-Second Annual Software Engineering Workshop; Dec. 1997, pp. 371-409; In English; See also 19990025789; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

In analyzing the stability of a maintenance process, it is important that it not be treated in isolation from the reliability and risk of deploying the software that result from applying the process. Furthermore, we need to consider the efficiency of the test effort that is a part of the process and a determinate of reliability and risk of deployment. Therefore, we were motivated to integrate these factors into a unified approach. Our contribution to maintenance is the integration and measurement of these factors so that the influence of maintenance actions and test effort on the reliability of the software and the risk of deploying it can be assessed. We use a safety critical application of National visibility - the NASA Space Shuttle - as an example application of the unified approach.
Author
Safety; Software Reliability; Software Engineering; Computer Systems Performance; Program Verification (Computers); Systems Analysis; Maintenance; Systems Health Monitoring

19990025807 West Virginia Univ., NASA Independent Software 4 and 5 Facility, Fairmont, WV USA
Verification and Validation in a Rapid Software Development Process
Callahan, John R., West Virginia Univ., USA; Easterbrook, Steve M., West Virginia Univ., USA; Software Engineering Laboratory Series: Proceedings of the Twenty-Second Annual Software Engineering Workshop; Dec. 1997, pp. 411-427; In English; See also 19990025789
Contract(s)/Grant(s): NAG2-797; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The high cost of software production is driving development organizations to adopt more automated design and analysis methods such as rapid prototyping, computer-aided software engineering (CASE) tools, and high-level code generators. Even developers of safety-critical software system have adopted many of these new methods while striving to achieve high levels of quality and reliability. While these new methods may enhance productivity and quality in many cases, we examine some of the risks involved in the use of new methods in safety-critical contexts. We examine a case study involving the use of a CASE tool that automatically generates code from high-level system designs. We show that while high-level testing on the system structure is highly desirable, significant risks exist in the automatically generated code and in re-validating releases of the generated code

after subsequent design changes. We identify these risks and suggest process improvements that retain the advantages of rapid, automated development methods within the quality and reliability contexts of safety-critical projects.
Author
Coders; Computer Programming; Design Analysis; Prototypes; Software Development Tools; Software Engineering; Software Reliability; Computer Systems Performance

19990025808 Institut Regional des Sciences Informatiques et des Telecommunications, Tunis, Tunisia
Using Semantic Distance to Make Adaptation Decisions
Jilani, Lamia Labed, Institut Regional des Sciences Informatiques et des Telecommunications, Tunisia; Mili, Ali, West Virginia Univ., USA; Software Engineering Laboratory Series: Proceedings of the Twenty-Second Annual Software Engineering Workshop; Dec. 1997, pp. 429-457; In English; See also 19990025789; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

In this extended abstract, we report on an experiment that we are conducting to derive a model that supports decision making in program adaptation. We refer to two specific decisions, which are closely related yet distinct: (1) Given a software specification K and a software component C that almost satisfies K (in a sense to be defined), is it best (most economical) to adapt C to satisfy K or to build a solution to K from scratch? (2) Given a software specification K and two software components C and C' that almost satisfy K, which of C and C' is a better adaptation candidate (costs less to adapt)? In principle at least, the first question is a special case of the second, since it amounts to comparing the available component C against the trivial (empty) program. Hence we will focus our attention on the second question, and discuss later to what extent our findings apply to the first question.
Derived from text
Computer Programs; Specifications; Syntax; Semantics; Computer Programming; Cost Analysis; Software Reuse; Software Engineering; Productivity; Systems Analysis

19990025809 Universidad Politecnica de Madrid, Facultad de Informatica, Madrid, Spain
Object Oriented Modeling Focused on a Linguistic Approach
Juristo, N., Universidad Politecnica de Madrid, Spain; Moreno, A. M., Universidad Politecnica de Madrid, Spain; Software Engineering Laboratory Series: Proceedings of the Twenty-Second Annual Software Engineering Workshop; Dec. 1997, pp. 461-474; In English; See also 19990025789; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

One of the main limitations attributed to Object Orientation by software engineers is the immaturity of the Object-Oriented analysis process. This article aims to propose an approach to formalize this process. This method is based on the use of linguistic information from informal specifications. This information is composed of words which, in turn denote elements of an 00 modeling, such as classes, properties, etc. These words have a particular meaning, and their use in the modeling is usually related with that meaning. So, the objective is to analyze this information from the semantic and syntactic viewpoint and extract, by means of a formal procedure, the components of an 00 system. This paper presents briefly the proposed approach and is focused on the results of its application by a set of students of our university.
Author
Object-Oriented Programming; Systems Analysis; Software Engineering; Computer Systems Design

19990025810 NASA Goddard Space Flight Center, Greenbelt, MD USA
Case Study of an Object-Oriented System: EOSDIS
Behnke, Jeanne, NASA Goddard Space Flight Center, USA; Sekira, Susan, NASA Goddard Space Flight Center, USA; Software Engineering Laboratory Series: Proceedings of the Twenty-Second Annual Software Engineering Workshop; Dec. 1997, pp. 475-494; In English; See also 19990025789; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Mission to Planet Earth (MTPE) 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 MTPE. The EOS Data and Information System (EOSDIS) is another component of MTPE 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 six 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. While there are many segments in EOSDIS (e.g., flight operations, network) this case study discusses the development of the science data processing segment (SDPS). We briefly review

the architecture of the system, the goals of the SDPS, and the development progress to date. This study highlights key software development challenges, experiences integrating COTS, and the difficulties of managing a complex system development effort.
Derived from text
Computer Programming; Data Acquisition; Earth Observing System (EOS); EOS Data and Information System; Object-Oriented Programming; Software Engineering; Systems Engineering; Distributed Processing; Systems Analysis; Programming Environments; Software Development Tools; Program Verification (Computers)

19990025811 Westinghouse Electric Corp., Commercial Nuclear Fuel Div., Pittsburgh, PA USA
Application of Use Case Approach to a Small Project
Ciccone, Larry, Westinghouse Electric Corp., USA; Kopp, Harold, Westinghouse Electric Corp., USA; Software Engineering Laboratory Series: Proceedings of the Twenty-Second Annual Software Engineering Workshop; Dec. 1997, pp. 495-513; In English; See also 19990025789; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Use Case analysis for requirements and design phases of the development of a commercial software product in a corporate environment is the focus of this paper. The effect of the following factors on the software development activity will be discussed: (1) the environment, (2) the project and (3) the process. Amazing improvements in requirement identification and initial product quality were achieved compared to the previous ”list of requirements” approach. There was no conceptual gap between the objects in the requirements and the design phases. Use Case analysis provided a process that resulted in up-front activities which improved quality and reduced rework in a small but complex project.
Derived from text
Computer Programming; Requirements; Software Engineering; Systems Analysis; Object-Oriented Programming; Graphical User Interface; Software Reliability; Programming Environments; Computer Systems Design

19990025892 Raytheon STX Corp., Lanham, MD USA
Creation and Delivery of New Superpixelized DIRBE Map Products ***Semiannual Report***
Weiland, J., Raytheon STX Corp., USA; August 1998; 3p; In English
Contract(s)/Grant(s): NAS5-97001
Report No.(s): NASA/CR-1998-208600; NAS 1.26:208600; 98-met-0581; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Phase 1 called for the following tasks: (1) completion of code to generate intermediate files containing the individual DIRBE observations which would be used to make the superpixelized maps; (2) completion of code necessary to generate the maps themselves; and (3) quality control on test-case maps in the form of point-source extraction and photometry. Items 1 and 2 are well in hand and the tested code is nearly complete. A few test maps have been generated for the tests mentioned in item 3. Map generation is not in production mode yet.
Author
Computer Programs; Map Matching Guidance; Mapping

19990025923 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
A Web-based Prototype for AFIT Edplan Administration
Lee, Tien-Chen; Dec. 1998; 99p; In English
Contract(s)/Grant(s): Proj-
Report No.(s): AD-A359436; AFIT/GCS/ENG/98D-02; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

This document details the design, development, and evaluation of a prototype course registration and reporting system for the students and faculty of the USA Air Force Institute of Technology. The web-based system provides HTML-based client interfaces and Active Server Page server processes for interaction with the relational databases used to manage course and personnel data. The system prototype was developed following the ”Engineering Software Components for Web-Database Access” methodology of Dipiro. A survey of modern web-based database access techniques is first provided and Dipiro’s methodology is reviewed as background. The remainder of the document details the application of the methodology as a decision aid for decomposing system requirements into a series of user interaction and data access functions. Then, again following the methodology, an analysis of extant web-database access techniques is performed in the search for the most appropriate one. Next, the developed prototype system’s functions are described and depicted via screen capture images. Finally the results of prototype evaluation via user feed-

back surveys are provided along with recommendations for future system improvement. Ultimately, this work stands as a validating test case for the Dipiro's methodology.
DTIC
Software Engineering; Internets; Relational Data Bases; Document Markup Languages; Computer Programs; Decision Support Systems; Object-Oriented Programming

19990025924 Stanford Univ., Stanford, CA USA
Microsupercomputers: Design and Implementation ***Final Report, Aug. 1987 - Aug. 1991***
Hennessy, John L.; Horowitz, Mark A.; Oct. 01, 1998; 27p; In English
Contract(s)/Grant(s): N00014-87-K-0828
Report No.(s): AD-A359437; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This research project was to explore and develop the technologies necessary to build high performance computers from low-cost VLSI-based microprocessors. The project embraced a wide set of technologies for achieving these goals; (1) Novel parallel computer architectures and associated parallel software; (2) High performance microprocessor design; (3) High speed CMOS and BiCMOS design; and (4) Development of key supporting technologies such as testing and CAD technologies.
DTIC
Computer Programs; Computer Aided Design; Microprocessors; Architecture (Computers)

19990025958 Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA
RLOGIN(1): The Untold Story ***Final Report***
Rogers, Lawrence R.; Nov. 1998; 42p; In English
Contract(s)/Grant(s): F19628-95-C-0003
Report No.(s): AD-A358797; CMU/SEI-98-TR-017; ESC*-TR-98-017; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Coding defects account for a significant portion of the reports received by the CERT(registered) Coordination Center. Through in-depth analysis of these reports and generalizing our findings from those analyses, we have begun to create guidelines for mitigation strategies for existing defects and avoidance strategies when coding new software. In this document, we report the results of our analysis of the well known defect in the rlogin program. We discuss the coding defect in detail, three mitigation strategies devised to remedy the defect, and two avoidance strategies offered as a guide to reducing the instances of similar coding defects in new programs. We end with three design notes aimed at eliminating these defects at the hardware and protocol design level.
DTIC
Defects; Protocol (Computers)

19990025975 Lockheed Martin Corp., Orlando, FL USA
Advanced Distributed Simulation Technology II (ADST II) High Level Architecture Support Experiments ***Final Report***
Mar. 25, 1998; 407p; In English
Contract(s)/Grant(s): N61339-96-D-0002
Report No.(s): AD-A358658; ADST-II-CDRL-011R-9600166; No Copyright; Avail: CASI; A18, Hardcopy; A04, Microfiche
The purpose of the High Level Architecture (HLA) Support Experiments (HSE) project was to perform experimentation and research in HLA technology to support the evolution and further implementation of the HLA specifications. This project was performed as Delivery Order (DO) #0041 under the Lockheed Martin Advanced Distributed Simulation, Training and Instrumentation Command (STRICOM). The project work was sponsored by the Defense Modeling and Simulation Office (DMSO).
DTIC
Simulation; Systems Simulation; Human Factors Engineering

19990026045 Carnegie-Mellon Univ., School of Computer Science, Pittsburgh, PA USA
An Evaluation of Linear Models for Host Load Prediction
Dinda, Peter A., Carnegie-Mellon Univ., USA; OHallaron, David R., Carnegie-Mellon Univ., USA; Nov. 1998; 29p; In English
Contract(s)/Grant(s): F30602-96-1-0287; NSF-CMS-93-18163
Report No.(s): AD-A358577; CMU-CS-98-148; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This paper evaluates linear models for predicting the Digital UNIX five-second load average from 1 to 30 seconds into the future. A detailed statistical study of a large number of load traces leads to consideration of the Box-Jenkins models (AR, MA, ARMA, ARIMA), and the ARFIMA models (due to self-similarity.) These models, as well as a simple windowed-mean scheme,

are evaluated by running a large number of randomized testcases on the load traces. The main conclusions are that load is consistently predictable to a useful degree, and that the simpler models such as AR are sufficient for doing this prediction.
DTIC
UNIX (Operating System); Analogies

19990026048 Carnegie-Mellon Univ., School of Computer Science, Pittsburgh, PA USA
Stack-Based Typed Assembly Language
Morrisett, Greg, Carnegie-Mellon Univ., USA; Crary, Karl, Carnegie-Mellon Univ., USA; Walker, David, Carnegie-Mellon Univ., USA; Glew, Neal, Carnegie-Mellon Univ., USA; Nov. 1998; 33p; In English
Contract(s)/Grant(s): F49620-97-1-0013; F30602-96-1-0317
Report No.(s): AD-A358572; CMU-CS-FOX-98-05; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In previous work, we presented Typed Assembly Language (TAL). TAL is sufficiently expressive to serve as a target language for compilers of high level languages such as ML. That work assumed such a compiler would perform a continuation passing style transform and eliminate the control stack by heap allocating activation records. However, most compilers are based on stack allocation. This paper presents STAL, an extension of TAL with stack constructs and stack types to support the stack allocation style. We show that STAL is sufficiently expressive to support languages such as Java, Pascal, and ML; constructs such as exceptions and displays; and optimizations such as tail call elimination and callee saves registers. This paper also formalizes the typing connection between CPS based compilation and stack based compilation and illustrates how STAL can formally model calling conventions by specifying them as formal translations of source function types to STAL types.
DTIC
Assembly Language; Display Devices; High Level Languages; Pascal (Programming Language)

19990026050 Carnegie-Mellon Univ., School of Computer Science, Pittsburgh, PA USA
Experiments With Parallel Pointer-Based Algorithms
Reid-Miller, Margaret, Carnegie-Mellon Univ., USA; May 1998; 98p; In English
Contract(s)/Grant(s): DABT63-96-C-0071
Report No.(s): AD-A358565; CMU-CS-98-127; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

Although parallel pointer based algorithms have been studied extensively by the research community, implementations have met with marginal success, even for the simplest applications. In a careful implementation study of parallel list ranking (and the related list scan operation) and parallel dynamic balanced trees operations, I show that indeed parallel pointer based algorithms can have substantial speed up over fast workstations. List ranking is over 200 times faster on a CRAY C90 than on a high end DEC Alpha workstation, and the balance tree algorithms are 6.3 to 6.8 times faster on eight processors than on one of a SGI Power Challenge, and 4.1 to 4.4 times faster on five processors than on one of a SUN Ultra Enterprise 3000. List ranking is a primitive in many parallel tree and graph algorithms, while dynamic balanced trees are important for maintaining databases, providing ordered set operations, and index searching. The parallel algorithms for list ranking and balanced trees are new; the key to their success is that they are both work optimal and very simple. In fact, the algorithms for set operations seem simpler than any previous sequential algorithms with the same work bounds, and might, therefore, be useful in a sequential context. The algorithms as implemented, however, do not have optimal depth (parallel time). This dissertation shows how to reduce the depth of the tree algorithms to make them optimal by using pipelining. Pipelining has been used previously, but the method used here allows for asynchronous execution and for pipeline delays that are data dependent and dynamic. Rather than making the coding more difficult, the method lets the user write the algorithms using futures (a parallel language construct) and leaves the management of the pipelining to an efficient runtime system.
DTIC
Cray Computers; Data Bases; Dials; Pipelines; Pipelining (Computers); Ranking

19990026063 Department of Energy, Washington, DC USA
Variance propagation by simulation (VPSim)
Burr, T. L., Department of Energy, USA; Coulter, C. A., Department of Energy, USA; Prommel, J. M., Department of Energy, USA; Jul. 31, 1997; 10p; In English; 38th, USA
Report No.(s): DE97-008985; LA-UR-97-2549; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The application of propagation of variance (POV) for estimating the variance of a material balance is straight forward but tedious. Several computer codes exist today to help perform POV. Examples include MAWST ('materials accounting with sequential testing,' used by some Department of Energy sites) and VP ('variance propagation,' used for training). Also, some sites have such simple error models that custom 'spreadsheet like' calculations are adequate. Any software to perform POV will have its

strengths and weaknesses. A main disadvantage of MAWST is probably its limited form of error models. This limited form forces the user to use cryptic pseudo measurements to effectively extend the allowed error models. A common example is to include sampling error in the total random error by dividing the actual measurement into two pseudo measurements. Because POV can be tedious and input files can be presented in multiple ways to MAWST, it is valuable to have an alternative method to compare results. This paper describes a new code, VPSim, that uses Monte Carlo simulation to do POV. VPSim does not need to rely on pseudo measurements. It is written in C++, runs under Windows NT, and has a user friendly interface. VPSim has been tested on several example problems, and in this paper we compare its results to results from MAWST. We also describe its error models and indicate the structure of its input files. A main disadvantage of VPSim is its long run times. If many simulations are required (20,000 or more, repeated two or more times) and if each balance period has many (10,000 or more) measurements, then run times can be one-half hour or more. For small and modest sized problems, run times are a few minutes. The main advantage of VPSim is that its input files are simple to construct, and therefore also are relatively easy to inspect.
NTIS
Computerized Simulation; Monte Carlo Method; Random Errors; Simulation

19990026094 Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA
A Study of Practice Issues in Model-Based Verification Using the Symbolic Model Verifier (SMV) ***Final Report***
Srinivasan, Grama R.; Gluch, David P.; Nov. 1998; 57p; In English
Contract(s)/Grant(s): F19628-95-C-0003
Report No.(s): AD-A358751; CMU/SEI-98-TR-013; ESC*-TR-98-013; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report presents the results of a case study into practice issues involved in using the Symbolic Model Verifier (SMV) for model checking software systems. The case study is of a Simplex implementation-the Simplex coordinated demonstration system for reliable system upgrade. The investigation consisted of generating a system model (using both statechart and SMV notations), specifying claims (expected properties) of the system as temporal logic formulae, and checking those formulae with respect to the SMV model. The various steps involved in the modeling process are described. Examples of the claims, their results, and a description of how the SMV tool analyzed them are detailed. Key engineering decisions made during the modeling process and a work breakdown of the effort are also presented.
DTIC
Software Engineering; Temporal Logic

19990026107 Prediction Systems, Inc., Spring Lake, NJ USA
Network Simulation of Technical Architecture
Cave, William C.; Wassmer, Robert E.; Sep. 30, 1998; 21p; In English
Contract(s)/Grant(s): DAA-L01-97-C-0093
Report No.(s): AD-A359457; PSI-98002; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This SBIR Phase II effort was aimed at implementation of an interactive graphics facility for network modeling to simulate battle command technical architectures to guide the definition, design, and development of the Army Battle Command System (ABCS). PSI delivered a hierarchical iconic modeling facility that can be used to structure and restructure both models and scenarios, interactively, while simulations are running. This tool provides an open environment in which modelers can develop their own tailored models and share them easily with anyone. These models can be copied and modified by different organizations for use in different applications while being protected from unwanted change at the same time. During this effort, PSI built and demonstrated advanced run-time graphics facilities for hierarchical icons which support the deployment of an aggregate facility, such as a shelter, and the push-down of this facility into basic entities, such as various terminals, computers, multiplexors, switches and radios of different types, with appropriate graphic interaction at each level in the hierarchy. In addition, hierarchical icon movement, where icons can contain subicons that move independently of each other, but relative to the next level in the hierarchy, was demonstrated.
DTIC
Computer Networks; Architecture (Computers); Computer Graphics; Simulation

19990026201 Physics and Electronics Lab. TNO, The Hague, Netherlands
ModSAF ***Final Report Interim Rapportage ModSAF***
Bloem, M., Physics and Electronics Lab. TNO, Netherlands; Jansen, R. E. J., Physics and Electronics Lab. TNO, Netherlands; Wijckmans, P. M. E. J., Physics and Electronics Lab. TNO, Netherlands; November 1998; In Dutch; Original contains color illustrations

Contract(s)/Grant(s): A95/KL/842
Report No.(s): TD97-0388; FEL-98-A023; Copyright; Avail: Issuing Activity (TNO Physics and Electronics Lab., P.O. Box 96864, 2509 JG The Hague, The Netherlands), Hardcopy, Microfiche

ModSAF (Modular Semi Automated Forces) is a software package for generation of scenarios and simulation of Computer Generated Forces (CGF). Within TNO-FEL it is used in the research for the use of distributed simulations on the subject of Training and Education and Command and Control. This report summarizes the current state of ModSAF and identifies future developments on the subjects of Training and Education and Command and Control within the Netherlands Armed Forces.
Author
Applications Programs (Computers); Computer Programs; Training Simulators

19990026212 Department of Energy, Office of Energy Research, Washington, DC USA
Report on the workshop on Monte Carlo simulation of neutron scattering instruments
Crawford, R. K., Department of Energy, USA; Jan. 09, 1998; 16p; In English, USA
Report No.(s): DE98-057796; ANL/IPNS/CP-95798; CONF-9711167-SUMM; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The main purpose of this workshop was to reach a consensus concerning the desired features of a general computer program for source-to-detector Monte Carlo simulation of neutron scattering instruments. A second goal was to decide on a strategy for achieving this and to begin to portion out the tasks involved to avoid duplication of efforts among the various groups. The meeting was organized by Kent Crawford (Argonne National Laboratory) and attended by representatives of all the major US neutron scattering facilities and several of the European neutron scattering facilities. This document is a summary of the discussions that took place during the workshop. A copy of the meeting schedule is attached, as well as a list of participants.
NTIS
Monte Carlo Method; Neutron Scattering; Measuring Instruments; Computerized Simulation

19990026443 Army Research Lab., Sensors Directorate, Adelphi, MD USA
A MATLAB Radar Range Equation and Probability of Detection Evaluation Tool ***Final Report, Jul. - Sep. 1998***
Scheiner, Barry; Jan. 1999; 22p; In English
Report No.(s): AD-A360040; ARL-TR-1806; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

I have developed a graphical user interface (GUI) that makes the process of evaluating the radar range equation faster and more convenient. From this GUI, one can enter the input parameters necessary to compute the signal-to-noise ratio (SNR) and probability of detection (P(d)) of a radar system as a function of range, and view the results graphically. The GUI and the SNR and P(d) computations are coded using the MATLAB programming language. I review the derivation of the equation used to evaluate the P(d) of a signal detected by a linear quadrature detector and provide examples of the GUI's operation.
DTIC
Computerized Simulation; Human-Computer Interface; Graphical User Interface; Target Acquisition; Computer Programs

19990026504 Joint Advanced Distributed Simulation Joint Test Force, Albuquerque, NM USA
A Plug and Play Joint Test Environment for Future Operational Testing
Marchand, Gary; Jan. 1998; 9p; In English
Report No.(s): AD-A359371; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The End-to-End (ETE) Test, conducted under the auspices of the Department of Defense Joint Advanced Distributed Simulation (JADS) Joint Test and Evaluation (JT&E), is currently developing a synthetic test environment that can be used for future operational testing and doctrinal development. This synthetic test environment is a joint venture, involving both the ETE and the US Army's Test and Experimentation Command (TEXCOM), and will be used initially to conduct operational testing of the Joint Surveillance Target Attack Radar System (Joint STARS) and future C4ISR systems. The test environment will be the result of the merging of two advanced distributed simulation (ADS) environments that consist of live elements, hardware in the loop, DIS compliant simulations, and constructive legacy models. The ADS environments involved are the ETE Joint STARS Target Attack Environment and the Simulation Test Operational, Rehearsal Model (STORM) Environment. The plug and play aspects of this Joint Test Environment are best illustrated by current discussions with the US Air Force regarding the addition of an Air Force Target Exploitation Environment. Addition of this environment would allow the investigation of doctrinal issues of interest to both the Air Force and the Army, and further operational testing of Joint STARS. Additionally, the elements comprising the nodes may be represented by simulations or by the actual system, since all of the communication is doctrinally correct and may be passed using actual communications systems. As an example, the Improved Army Tactical Missile System could replace the currently simulated Army Tactical Missile System and operational testing could be rehearsed and conducted using a variety of operational

and doctrinal schema. This paper describes the architecture of the Joint Test Environment, current developmental efforts, and potential future expansions and uses of the environment.
DTIC
Computerized Simulation; Systems Analysis; Surveillance Radar; Environment Simulation; Missile Systems

19990026506 Joint Advanced Distributed Simulation Joint Test Force, Albuquerque, NM USA
Analysis Tools and Procedures for Distributed Networks
Smith, Sandra; Dec. 1998; 3p; In English; Presented at the International Test and Evaluation Association Modeling and Simulation Workshop 7-10 Dec 98.
Report No.(s): AD-A359376; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The Joint Advanced Distributed Simulation (JADS) Joint Test Force (JTF) is chartered by the Office of the Secretary of Defense to investigate the utility of Advanced Distributed Simulation (ADS) Technology to Test and Evaluation (T&E). JADS is executing three formal test programs representing slices of the overall T&E spectrum to form its conclusions, linking live test assets, constructive models, and virtual simulations at multiple test facilities and test ranges across the country. Although each test targets different distributed equipment, all three tests have similar requirements for a methodology and tools that support evaluation of cross-country network performance and its impact on data quality. JADS uses a suite of both on-site and remote network monitoring tools to provide insight into distributed network performance before, during, and after test exercises. Prior to conducting any test exercise, it is important that a baseline analysis of the network's capabilities be performed. The comparison of baseline capabilities to projected network requirements allows identification of network shortcomings so that they can be addressed and provides confidence that distributed equipment will be able to communicate satisfactorily during testing. The baseline characterization of JADS network links includes Bit Error Rate Testing, or BERT, both no-load and loaded link latency testing, PDU (or HLA packet) verification testing, and stress testing. During JADS test execution, network analysis is an integral part of the test control and monitoring process. Latency, error rates, and data verification continue to be of high interest. In addition, packet rate, bandwidth utilization, link availability, and time synchronization across sites may be monitored real-time. A specific network portion may be monitored continuously if immediate notification of a network outage is necessary.
DTIC
Computer Networks; Computerized Simulation; Systems Analysis; Network Analysis; Systems Simulation; Real Time Operation

19990026634 Department of the Navy, Washington, DC USA
System and Method for Chaotic Signal Identification
Nguyen, Chung T., Inventor; O'Brien, Francis J., Jr., Inventor; Hammel, Sherry E., Inventor; Bates, Bruce J., Inventor; Nardone, Steven C., Inventor; Jul. 14, 1998; 12p; In English; Supersedes US-Patent-Appl-SN-682896
Patent Info.: Filed 28 Jun. 96,; US-Patent-5,781,460; US-Patent-Appl-SN-682,896
Report No.(s): AD-D019253; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A chaotic signal processing system receives an input signal provided by a sensor in a chaotic environment and performs a processing operation in connection therewith to provide an output useful in identifying one of a plurality of chaotic processes in the chaotic environment. The chaotic signal processing system comprises an input section, a processing section and a control section. The input section is responsive to input data selection information for providing a digital data stream selection information for providing a digital data stream selectively representative of the input signal provided by the sensor or a synthetic input representative of a selected chaotic process. The processing section includes a plurality of processing modules each for receiving the digital data stream from the input means and for generating therefrom an output useful in identifying one of a plurality of chaotic processes. The processing section is responsive to processing selection information to select one of the plurality of processing modules to provide the output. The control module generates the input data selection information and the processing selection information in response to inputs provided by an operator.
DTIC
Signal Processing; Modules; Data Flow Analysis; Digital Data

19990026649 Rutherford Appleton Lab., Chilton, UK
The EVEREST Doping Profile Module, 4
Ashby, J. V., Rutherford Appleton Lab., UK; Fowler, R. F., Rutherford Appleton Lab., UK; Greenough, C., Rutherford Appleton Lab., UK; Dec. 01, 1998; ISSN 1358-6254; 32p; In English
Report No.(s): RAL-TR-1999-006; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11 0QX, UK), Hardcopy, Microfiche

In this report we describe the EVEREST Doping Module which forms part of the EVEREST suite of programs. The doping module is responsible for generating a neutral file which gives the acceptor and donor densities at each node the device mesh. The neutral file also contains details of the functions used to generate the doping as mesh refinement in the solver requires this. Commands allow the definition of background doping, regions of uniform doping, non-uniform doping relating to windows found in the Geometry neutral file and a user-programmable FORTRAN subroutine which computes doping concentrations as a function of position. EVEREST suite is one of the products of the ESPRIT project EVEREST (ESPRIT 962E-17, Three-Dimensional Algorithms for a Robust and Efficient Semiconductor Simulator with Parameter Extraction). EVEREST was a four-year project supported by the European Community under the European Strategic Program for Research in Information Technology (ESPRIT) which is investigating suitable algorithms for the analysis of semiconductor devices in three dimensions, and developing software implementing the most effective of those algorithms.
Author
Computer Programs; Simulators; Semiconductor Devices; Information Systems; Grid Generation (Mathematics); Acceptor Materials

19990026718 Naval Postgraduate School, Monterey, CA USA
Development of a Graphical Numerical Simulation for Thermoacoustic Research
Purdy, Eric W.; Dec. 1998; 96p; In English
Report No.(s): AD-A359975; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
This thesis is written to document the design and use of an object-oriented, numerical simulation of thermoacoustic devices. The resulting expen system code entitled ”Design Simulation for Thermoacoustic Research”, or DSTAR, allows a unique new approach for the rapid design and simulation of thermoacoustic devices. Past approaches to thermoacoustic modeling have involved the use of ”disposable” algorithms coded to model one specific device. Conversely, DSTAR uses a Windows compliant graphical user interface to construct any given thermoacoustic model at runtime. As a result, the models can be developed quickly and without any revision of the computer code. The approach to simulation involves the solution of a one-dimensional acoustic wave equation concurrently with an energy flow equation from one end of the user-specified device geometry to the other in addition to various lumped acoustical elements. The resulting steady-state solution is displayed in both graphical and textual output. Considerable effort was given to preserving the flexibility and breadth of the possible simulations, in addition to allowing easy modification of the source code for new thermoacoustic components. to demonstrate the utility of the code, a thermoacoustic prime mover was modeled and then optimized for better performance.
DTIC
Mathematical Models; Computerized Simulation; Computer Aided Design; Acoustics

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COMPUTER SYSTEMS

Includes computer networks and special application computer systems.

19990025205 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China
A Performance Study of Cache Coherence Protocols and Write Caches for Parallel Multithreaded Shared-Memory Multiprocessors
Wu, Chao-Chin, National Chiao Tung Univ., Taiwan, Province of China; Chen, Cheng, National Chiao Tung Univ., Taiwan, Province of China; Journal of the Chinese Institute of Engineers: Transactions of the Chinese Institute of Engineers, Series A; January 1998; ISSN 0253-3839; Volume 21, No. 1, pp. 33-46; In English
Contract(s)/Grant(s): NSC-86-2213-E-009-094; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
According to published research results, no directory-based cache coherence protocol provides best performance for all application programs in conventional multiprocessor systems that use sequential consistency models. However, recently it has been claimed that competitive-update protocols are superior to other protocols under a relaxed consistency model. Moreover, incorporating write caches improves the system performance of clean and competitive-update protocols. In this paper, we examine the different effects that occur when processing elements are replaced by parallel-multithreaded processors. According to our simulation results, the clean protocol provided the best performance for five out of six SPLASH programs. After augmentation with write caches, the clean protocol outperformed others for all applications. Though competitive-update protocols have been improved, their performance is not better than that of write-invalidate protocols for most programs.
Author
Multiprocessing (Computers); Computer Systems Performance; Protocol (Computers); Performance Tests

19990025207 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China

Adaptation to Network Link Bandwidth Fluctuation in WWW

Chang, Ruay-Shiung, National Taiwan Univ. of Science and Technology, Taiwan, Province of China; Kuo, Wun-Da, National Taiwan Univ. of Science and Technology, Taiwan, Province of China; Journal of the Chinese Institute of Engineers: Transactions of the Chinese Institute of Engineers, Series A; January 1998; ISSN 0253-3839; Volume 21, No. 1, pp. 59-72; In English

Contract(s)/Grant(s): NSC-85-2622-E-007-009; NSC-85-2221-E-011-003; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The rapid growth in the number of Internet users makes Internet accessing speed increasingly slower. When applications that require a large amount of bandwidth, for example, the World Wide Web (WWW), are running through these snail-like connections, delays and response time are often intolerable. Sometimes, the user's screen is stuck for a long time. World Wide Web becomes world wide wait. to increase responsiveness, a bandwidth sensitive hypertext transfer protocol is proposed in this paper. This protocol possesses the capability to match the amount and nature of the data transmitted with the amount of bandwidth available in the connection. That is, it tries to keep the communication going meaningfully and responsively as far as the connection bandwidth allows. This protocol can be applied to any situation where the available bandwidth is often inadequate and constantly changing. For example, in wireless networks where the connection bandwidth is limited and often variable, this protocol can be used to decrease response time and increase users' satisfaction. New tags are provided in the hypertext markup language for the user to structure the document such that the protocol can identify the important and meaningful part to be transmitted during bandwidth scarcity. A method is also devised to structure the document automatically if the user does not. Experiments on several HTML documents under different bandwidth availability indicate that the modified protocol indeed will make WWW transmission proceed more smoothly and less sporadically.

Author

World Wide Web; Document Markup Languages; Protocol (Computers); Data Transmission; Internets; Bandwidth

19990025289 Warner Robins Air Logistics Center, Robins AFB, GA USA

SMART Shop ***Final Report***

Galbreath, Verlon; Feb. 23, 1993; 17p; In English

Report No.(s): AD-A359004; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A bar code based end item tracking and data collection system was designed for testing on four avionics production lines. A high priority was given to providing features which would replace paper based tasks with bar code scanning techniques. Databases and application programs hosted on minicomputers would log test and repair data as it occurred. The accumulated history would immediately be available at terminals in the shop area. End item status, failure and repair data, replaced components, and field generated performance information were included. Information required by external data systems was assimilated and transferred electronically. The project was given the name SMART Shop (Statistical Maintenance and Repair Techniques). This project gives the depot shop an on-line electronic data resource to record test and repair actions as they occur. The data is instantly available at any other workstation to which the end item may go. The technician also has access to information relating to field reports of the end item's performance and all prior test and repair actions. A major feature of the project is that it allows documenting and evaluating of any repair process improvement effort without setting up a stand alone database for tracking purposes. by replacing workbooks, maintenance data collection forms, inventory logbooks, and parts ordering forms with bar code scanning technology and electronic data communications, the average end item labor requirement is reduced by 35 minutes.

DTIC

Statistical Analysis; Minicomputers; Data Transmission; Data Systems; Data Bases; Data Acquisition

19990025297 Virginia Univ., Dept. of Computer Science, Charlottesville, VA USA

Integrated Task and Data Parallel Programming

Grimshaw, A. S., Virginia Univ., USA; November 1998; 10p; In English

Contract(s)/Grant(s): NGT1-52101

Report No.(s): UVA/528538/CS99/101; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This research investigates the combination of task and data parallel language constructs within a single programming language. There are an number of applications that exhibit properties which would be well served by such an integrated language. Examples include global climate models, aircraft design problems, and multidisciplinary design optimization problems. Our approach incorporates data parallel language constructs into an existing, object oriented, task parallel language. The language will support creation and manipulation of parallel classes and objects of both types (task parallel and data parallel). Ultimately, the language will allow data parallel and task parallel classes to be used either as building blocks or managers of parallel objects of either type, thus allowing the development of single and multi-paradigm parallel applications. 1995 Research Accomplishments

In February I presented a paper at Frontiers 1995 describing the design of the data parallel language subset. During the spring I wrote and defended my dissertation proposal. Since that time I have developed a runtime model for the language subset. I have begun implementing the model and hand-coding simple examples which demonstrate the language subset. I have identified an astrophysical fluid flow application which will validate the data parallel language subset. 1996 Research Agenda Milestones for the coming year include implementing a significant portion of the data parallel language subset over the Legion system. Using simple hand-coded methods, I plan to demonstrate (1) concurrent task and data parallel objects and (2) task parallel objects managing both task and data parallel objects. My next steps will focus on constructing a compiler and implementing the fluid flow application with the language. Concurrently, I will conduct a search for a real-world application exhibiting both task and data parallelism within the same program. Additional 1995 Activities During the fall I collaborated with Andrew Grimshaw and Adam Ferrari to write a book chapter which will be included in Parallel Processing in C++ edited by Gregory Wilson. I also finished two courses, Compilers and Advanced Compilers, in 1995. These courses complete my class requirements at the University of Virginia. I have only my dissertation research and defense to complete.
Derived from text
Parallel Processing (Computers); Parallel Programming; Design Analysis; Fluid Flow; Climatology; Astrophysics

19990025448 Raytheon Co., Greenbelt, MD USA
Computing with Beowulf
Cohen, Jarrett, Raytheon Co., USA; R and D Magazine; 1999; 5p; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Parallel computers built out of mass-market parts are cost-effectively performing data processing and simulation tasks. The Supercomputing (now known as ”SC”) series of conferences celebrated its 10th anniversary last November. While vendors have come and gone, the dominant paradigm for tackling big problems still is a shared-resource, commercial supercomputer. Growing numbers of users needing a cheaper or dedicated-access alternative are building their own supercomputers out of mass-market parts. Such machines are generally called Beowulf-class systems after the 11th century epic. This modern-day Beowulf story began in 1994 at NASA’s Goddard Space Flight Center. A laboratory for the Earth and space sciences, computing managers there threw down a gauntlet to develop a $50,000 gigaFLOPS workstation for processing satellite data sets. Soon, Thomas Sterling and Don Becker were working on the Beowulf concept at the University Space Research Association (USRA)-run Center of Excellence in Space Data and Information Sciences (CESDIS). Beowulf clusters mix three primary ingredients: commodity personal computers or workstations, low-cost Ethernet networks, and the open-source Linux operating system. One of the larger Beowulfs is Goddard’s Highly-parallel Integrated Virtual Environment, or HIVE for short.
Derived from text
Computer Networks; Low Cost; Parallel Computers; Personal Computers; Supercomputers; Workstations; Real Time Operation; Multiprocessing (Computers)

19990025767 Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA
Handbook for Computer Security Incident Response Teams (CSIRTs) ***Final Report***
West-Brown, Moira; Stikvoort, Don; Kossakowski, Klaus-Peter; Dec. 1998; 183p; In English
Contract(s)/Grant(s): F19628-95-C-0003
Report No.(s): AD-A358945; CMU/SEI-98-HB-001; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

This document provides guidance on the generic issues to consider when forming and operating a computer security incident response team (OSIRT). In particular, it helps an organization to define and document the nature and scope of a computer security incident response (OSIR) service, which is the core service of a CSlRT. The document discusses the functions that make up the service; how those functions interrelate; and the tools, procedures, and roles necessary to implement the service. This document also describes how OSIRTs interact with other organizations and how to handle often sensitive information. In addition, operational and technical issues are addressed, such as equipment, security, and staffing considerations. This document is intended to provide a valuable resource to both newly forming teams and existing teams whose services, policies, and procedures are not clearly defined or documented. The primary audience for this document consists of managers responsible for the creation or operation of a CSlRT or a CSlR service. It can also be used as a reference for all OSIRT staff, higher-level managers, and others who interact with a OSIRT.
DTIC
Computer Information Security; Handbooks; Organizations

19990025908 Department of Energy, Washington, DC USA

QoS routing via multiple paths using bandwidth reservation

Rao, N. S. V., Department of Energy, USA; Batsell, S. G., Department of Energy, USA; Nov. 30, 1997; 32p; In English; Computer Communications; Sponsored by Institute of Electrical and Electronics Engineers, USA

Report No.(s): DE98-001424; ORNL/CP-95289; CONF-9703134; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors address the problem of computing a multipath, consisting of possibly overlapping paths, to transmit data from the source node s to the destination node d over a computer network while ensuring deterministic bounds on end-to-end delay or delivery rate. They consider two generic routing problems within the framework wherein bandwidth can be reserved, and guaranteed, once reserved, on various links of the communication network. The first problem requires that a message of finite length be transmitted from s to d within tau units of time. The second problem requires that a sequential message of r units be transmitted at a rate of eta such that maximum time difference between two units that are received out of order is no more than q. They propose a polynomial-time algorithm to the first problem based on an adaptation of the classical Ford-Fulkerson's method. They present simulation results to illustrate the applicability of the proposed algorithm. They show the second problem to be NP-complete and propose a polynomial-time approximate solution.

NTIS

Bandwidth; Multipath Transmission

19990025973 Army Research Lab., Sensors Directorate, Adelphi, MD USA

New Result in Quantum Cryptography

Brandt, Howard E.; Jan. 1998; 3p; In English

Report No.(s): AD-A358653; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In the entangled translucent eavesdropping scenario of key generation in quantum cryptography, I demonstrate that the unsafe error rate based on standard mutual information comparisons is equivalent to the maximum allowable error rate based on perfect mutual information for the eavesdropper. In this case, the unsafe error rate is not in fact overly conservative, as is commonly supposed.

DTIC

Cryptography; Translucence; Transparence

19990026049 Carnegie-Mellon Univ., School of Computer Science, Pittsburgh, PA USA

On Distributed Network Resource Allocation

Richa, Andrea Werneck, Carnegie-Mellon Univ., USA; Jan. 1998; 124p; In English

Contract(s)/Grant(s): NSF-CCR-94-57766

Report No.(s): AD-A358569; CMU-CS-98-146; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This thesis addresses several resource allocation problems that arise in the context of distributed networks. First, we present a scheme for accessing shared copies of objects in a network that has asymptotically optimal expected cost per access for a class of cost functions that captures the hierarchical structure of most wide area networks. Second, we present an off-line polynomial time algorithm that finds an asymptotically optimal schedule for the movement of packets whose paths through a network have already been determined. This is an improvement on a previous result by Leighton, Maggs, and Rao, who proved the existence of such schedules; their proof, however, was not constructive. Finally we present a polynomial time O(log n) approximation algorithm for finding an embedding of a network with n processors into an n-node linear array so as to minimize the weighted sum of the edge dilations i.e., for the minimum linear arrangement problem. This problem is NP hard, and the previous best approximation bound known was O(log n log, log n). In the case of planar networks, we bring the approximation factor down to O(log, log n). We also extend our approximation techniques to the minimum storage time product and the minimum containing interval graph problem.

DTIC

Algorithms; Graph Theory; Linear Arrays; Packets (Communication); Wide Area Networks; Resource Allocation

19990026112 Naval Postgraduate School, Monterey, CA USA

An Analysis of Federal Budget Information on the World Wide Web

Goodwin, Brian M.; Dec. 1998; 134p; In English

Report No.(s): AD-A359352; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The evolution of the Internet has progressed significantly, encouraging organizations to improve the quality of information in websites. This phenomenon has impacted sources of information available on the federal budget. This thesis examines this

development by documenting the scope of federal budget information on the Internet. Literature on the federal budget process and the World Wide Web was reviewed. More than 120 executive, legislative and private interest group websites were sampled. Websites were characterized using the criteria of timeliness of data, accessibility to data and ideological orientation. The thesis concludes that significant federal budget information is available on the Internet. In terms of web-publishing federal budget data, Congress and proprietary sites were the most timely. Accessibility varied with the significance to the website sponsor of federal budget policies. An ideological range within the websites sampled was depicted, from the ostensibly neutral to the obviously partisan. The thesis provides a discussion and examples of websites sponsored by many federal and private organizations. Web users interested in the federal budget can benefit from this information to guide their use of the Internet.
DTIC
Internets; Organizations; Policies; World Wide Web; Federal Budgets

19990026263 Department of Energy, Office of Energy Research, Washington, DC USA
Eighth SIAM conference on parallel processing for scientific computing: Final program and abstracts
Dec. 31, 1997; 71p; In English; 8th; Parallel processing for scientific computing
Report No.(s): DE98-002989; CONF-9703157-ABSTS; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This SIAM conference is the premier forum for developments in parallel numerical algorithms, a field that has seen very lively and fruitful developments over the past decade, and whose health is still robust. Themes for this conference were: combinatorial optimization; data-parallel languages; large-scale parallel applications; message-passing; molecular modeling; parallel I/O; parallel libraries; parallel software tools; parallel compilers; particle simulations; problem-solving environments; and sparse matrix computations.
NTIS
Parallel Processing (Computers); Conferences; Algorithms

19990026398 Department of Energy, Washington, DC USA
Development of a dynamic time sharing scheduled environment ***Final Report***
Oct. 01, 1997; 5p; In English
Report No.(s): DE98-006076; LLNL-98006076; No Copyright; Avail: Linthicum Heights, MD 21090-2934), Microfiche

Massively parallel computers, such as the Cray T3D, have historically supported resource sharing solely with space sharing. In that method, multiple problems are solved by executing them on distinct processors. This project developed a dynamic time- and space-sharing scheduler to achieve greater interactivity and throughput than could be achieved with space-sharing alone. CRI and LLNL worked together on the design, testing, and review aspects of this project. There were separate software deliverables. CRI implemented a general purpose scheduling system as per the design specifications. LLNL ported the local gang scheduler software to the LLNL Cray T3D. In this approach, processes are allocated simultaneously to all components of a parallel program (in a gang) . Program execution is preempted as needed to provide for interactivity. Programs are also relocated to different processors as needed to efficiently pack the computer's torus of processors. In phase one, CRI developed an interface specification after discussions with LLNL for system-level software supporting a time- and space-sharing environment on the LLNL T3D. The two parties also discussed interface specifications for external control tools (such as scheduling policy tools, system administration tools) and applications programs. CRI assumed responsibility for the writing and implementation of all the necessary system software in this phase. In phase two, CRI implemented job- rolling on the Cray T3D, a mechanism for preempting a program, saving its state to disk, and later restoring its state to memory for continued execution. LLNL ported its gang scheduler to the LLNL T3D utilizing the CRI interface implemented in phases one and two. During phase three, the functionality and effectiveness of the LLNL gang scheduler was assessed to provide input to CRI time- and space-sharing efforts. CRI will utilize this information in the development of general schedulers suitable for other sites and future architectures. All phases of this project were completed on time and all deliverables were met without significant changes to the original statement of work.
NTIS
Supercomputers; Scheduling; Time Sharing; Applications Programs (Computers); Design Analysis; Massively Parallel Processors

19990026420 Department of Energy, Washington, DC USA
Time-dependent deterministic transport on parallel architectures using PARTISN
Alcouffe, R. E., Department of Energy, USA; Baker, R. S., Department of Energy, USA; Dec. 31, 1998; 8p; In English; Radiation protection and shielding: technologies for the new century
Report No.(s): DE98-003491; LA-UR-98-272; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In addition to the ability to solve the static transport equation, the authors have also incorporated time dependence into the parallel S(sub N) code PARTISN. Using a semi-implicit scheme, PARTISN is capable of performing time- dependent calculations for both fissioning and pure source driven problems. They have applied this to various types of problems such as shielding and prompt fission experiments. This paper describes the form of the time-dependent equations implemented, their solution strategies in PARTISN including iteration acceleration, and the strategies used for time-step control. Results are presented for a iron-water shielding calculation and a criticality excursion in a uranium solution configuration.
NTIS
Time Dependence; Transport Theory; Architecture (Computers); Parallel Processing (Computers)

19990026716 Anderson (Mitchell J.), Keaau, HI USA
Algebraic and Topological Structure of QOS (End to End) Within Large Scale Distributed Information Systems ***Final Report, Jan. - Jul. 1998***
Anderson, Mitchell J.; Mathews, Robert; Jan. 1999; 39p; In English
Contract(s)/Grant(s): F30602-98-C-0035; AF Proj. ALGI
Report No.(s): AD-A359965; AFRL-IF-RS-TR-1998-233; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
End-to-end quality of service (QoSete) in large scale distributed information systems (DIS) is essential for intelligent system acquisition and design. Without well-developed mechanisms to measure system performance in terms of user requirements, systems can only be built in an ad-hoc manner. The QoSete model formalizes the identification of user requirements and provides performance metrics that are based on empirically measurable attributes that indicate how well user requirements have been met. These performance metrics manifest through the Benefit Function, which is then used for resource dimensioning. Ideally, large scale DIS should be designed and built to efficiently match both system and capital resources to pre-defined user requirements. This avoids users receiving unacceptably low levels of service and/or expending unnecessary capital. The current barriers to achieving QoSete include a lack of understanding of user requirements, the lack of a practical interface between the users and system designers, the lack of a common framework for integration of concepts between the various areas of expertise within the system, and the lack of a mature composability theory that allows such systems to be designed in a modular sense. The work herein addresses to some degree (primarily at a high-level) each of these obstacles, as well as providing insight into a number of related issues.
DTIC
Distributed Processing; Systems Analysis; Information Systems; User Requirements

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.

19990025324 National Technical Univ., Athens Greece
IMACS/IFAC International Symposium on Soft Computing in Engineering Applications (SOFTCOM 1998) and the Third European Robotics, Intelligent Systems and Control Conference (EURISCON 1998)
Jan. 1998; 291p; In English
Report No.(s): AD-A358995; EOARD-CSP-98-1054; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche
The Final Proceedings for Third European Robotics, Intelligent Systems and Control Conference (EURISCON)
DTIC
Conferences; Robotics; Computer Aided Manufacturing; Artificial Intelligence

19990025330 Utah Univ., Salt Lake City, UT USA
An Automated Framework for Managing Design Complexity
Jacobs, Timothy M., Utah Univ., USA; Dec. 1998; 153p; In English
Report No.(s): AD-A359071; AFIT-FY99-18; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche
Complexity in modern product design is manifest through the interactions of large numbers of diverse parts and functions, and multiple design disciplines. The intricate web of synergistic relationships necessary to link components together makes it difficult for designers to assimilate or represent such complex designs in their totality. Since existing Computer Aided Design (CAD) software tools provide only limited support for managing complex designs, it is necessary to document and track complexity relationships independent of the actual CAD models. This reduces the level of detail that can be managed, while requiring more work

from the design team and increasing the risk of inconsistencies and errors in the design. to better support management of complex designs, this research integrates multiple design representations and the relationships among them into a single organizational framework. Its goal is to provide flexibility for designers to manage and evolve design representations for a variety of design processes and applications. This research uses design data objects to represent the aggregation hierarchy and relationships between design representations. Aggregation objects are introduced to organize the design into a multileveled hierarchy by encapsulating multiple design components or representations into single objects. This organization serves to abstract design information and facilitate understanding. The design effects that result from the synergistic interaction between components are captured in relationship objects. Relationship objects eliminate duplicate specification and ensure compatibility between components. Together, aggregation and relationship objects form well defined boundaries between design entities to facilitate simultaneous design and reuse. Changes to aggregation and relationship objects are captured in version objects that record the history of a design as it evolves.
DTIC
Computer Aided Design; Hierarchies; Complexity

19990025379 George Mason Univ., Fairfax, VA USA
A Comprehensive Approach to Sensor Management and Scheduling
McIntyre, Gregory A., George Mason Univ., USA; Jan. 1998; 162p; In English
Report No.(s): AD-A359079; AFIT-FY99-25; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Heterogeneous multisensor systems have been widely used in a variety of military and civilian applications. While the majority of research in multisensor systems is dedicated to military applications, other applications include robot navigation, autonomous vehicles and paramilitary operations. In general, single sensor systems only provide partial information on the state of the environment while multisensor systems rely on data fusion techniques to combine related data from multiple similar and/or dissimilar sensors. The goal of a multisensor system is to provide a synergistic effect that enhances the quality and availability of information about the state of the world over that which would be acquired solely from one sensor. Sensor management can be described as a system or process that provides automatic or semi-automatic control of a suite of sensors or measurement devices. Previous approaches to sensor management all appear to suffer from the mixing of sensor physical requirements with information needs. The result has been ad hoc point solutions that treat the problem as a single optimization task with a performance measure as a weighted sum of diverse, noncommensurate measures. This dissertation presents a new mathematical representation of the multisensor system to capture the sensor management process. Based on this representation, an original hierarchical sensor management model is developed that partitions the system into its constituent processes. These include the sensors themselves, the targets, the Fusion Space, and the Information Space. The Information Space is further partitioned into the Mission Manager, the Information Instantiator, and the Sensor Scheduler. Additionally, this dissertation describes a new approach which uses partially ordered sets to construct a goal-lattice that converts qualitative mission goals to quantitative values for different sensor actions.
DTIC
Data Management; Systems Analysis; Multisensor Fusion; Sensors; Adaptive Control

19990025384 Brunel Univ., Inst. of Computational Mathematics, Uxbridge UK
Robust Adaptive Finite Element Schemes for Viscoelastic Solid Deformation: An Investigative Study ***Final Report, 11 Sep. 1997 - 11 Nov. 1998***
Shaw, Simon, Brunel Univ., UK; Whiteman, J. R., Brunel Univ., UK; Dec. 08, 1998; 110p; In English
Contract(s)/Grant(s): N68171-97-M-5763
Report No.(s): AD-A359216; R/D-8336-MS-01; No Copyright; Avail: Issuing Activity, Microfiche

The major goal was to develop a framework for the adaptive finite element solution of quasistatic viscoelasticity problems in the context of the practical utility of the internal variable formulation, as used by Dr. A. R. Johnson of the Vehicle Technology Center, NASA, Langley, and the theoretical utility of the hereditary integral formulation, as used at BICOM. The first of these allows for practical software to be developed in a straightforward way from existing linear elasticity codes, while the second facilitates the derivation of mathematically rigorous a posteriori error estimates - the essential building block for adaptive finite element solvers. During the project we proposed and developed a hybrid algorithm blending the best features of these two approaches. Also, we implemented our a posteriori error estimates to produce software capable of automatic spatial error control based on adaptive meshing. A prototype version of this software is now mounted on Dr Johnson's workstation at NASA, Langley. Full details of the work undertaken on the Seed Project are also contained in the report.
DTIC
Robustness (Mathematics); Finite Element Method; Viscoelasticity; Deformation; Computer Programs; Adaptive Control

19990025482 Texas Univ., Dept. of Psychology, Austin, TX USA

A Foveated Imaging System to Reduce Transmission Bandwidth of Video Images from Remote Camera Systems ***Final Report, 30 Sep. 1994 - 31 Mar. 1995***

Geisler, Wilson S., Texas Univ., USA; Webb, H. L., Texas Univ., USA; Dec. 1998; 7p; In English

Contract(s)/Grant(s): F49620-96-C-0053; AF Proj. STTR

Report No.(s): AD-A358811; AFRL-SR-BL-TR-98-0858; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This is the final progress report for a joint project between Geisler's laboratory at the University of Texas at Austin and OWL Displays Inc., to develop a real time variable resolution (foveated) imaging system for video communications tasks such as remote control of unmanned vehicles. Although the OWL side of the project might best be described as a modest success, we believe the software and software/hardware integration performed at UT has been a big success. A general purpose real time linkable library (for Pentium class computers running the Windows 95/98/NT OS) has been developed for coding and decoding variable resolution static images and video, both in 8 bit gray scale and 24 bit color. We have tested our real time software in conjunction with MPEG (H.263) and shown that it generally produces very substantial bandwidth savings both for T frames and P frames. We have also developed our own real time image compression library which includes fast motion compensation, fast pyramid coding, fast zero tree coding and arithmetic coding. The foveated imaging software has been successfully interfaced and tested with a 512 x 512 8 bit b/w camera and two separate eye trackers: an ASL desktop heads free eye tracker and the OWL/ASL V8 helmet mounted eye tracker.

DTIC

Imaging Techniques; Bandwidth; Video Communication; Remote Control; Image Processing; Optical Communication; Video Signals

19990025484 Adroit Systems, Inc., Fairborn, OH USA

An Evaluation of Required Tools for the Imagery Analyst ***Interim Report, Oct. 1995 - Sep. 1997***

Oct. 1997; 66p; In English

Contract(s)/Grant(s): F41624-94-D-6000; AF Proj. 7184

Report No.(s): AD-A358837; AFRL-HE-WP-TR-1998-0005; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The drawdown in the military forces of the USA is leading to a reduction in both the numbers and experience level of trained imagery analysts. At the same time, emerging reconnaissance and surveillance system capabilities show great promise of increasing the coverage rates and sensed phenomenologies which may be obtained over the future battlefield. Automation may alleviate this "data overload" problem but only if it is applied with significant forethought. In order to prepare for technology insertion, the system designer must have a thorough appreciation of the tasks and preferred tools of the imagery analyst.

DTIC

Image Processing; Image Enhancement; Images; Radar Imagery

19990025668 Texas Inst. for Rehabilitation and Research, Houston, TX USA

Applying Space Technology to Enhance Control of an Artificial Arm for Children and Adults With Amputations ***Final Report***

Atkins, Diane J., Texas Inst. for Rehabilitation and Research, USA; Jun. 30, 1998; 5p; In English

Contract(s)/Grant(s): NCC9-36; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The first single function myoelectric prosthetic hand was introduced in the 1960's. This hand was controlled by the electric fields generated by muscle contractions in the residual limb of the amputee user. Electrodes and amplifiers, embedded in the prosthetic socket, measured these electric fields across the skin, which increase in amplitude as the individual contracts their muscle. When the myoelectric signal reached a certain threshold amplitude, the control unit activated a motor which opened or closed a hand-like prosthetic terminal device with a pincher grip. Late in the 1990's, little has changed. Most current myoelectric prostheses still operate in this same, single-function way. to better understand the limitations of the current single-function myoelectric hand and the needs of those who use them, The Institute for Rehabilitation and Research (TIRR), sponsored by the National Institutes of Health (NUH), surveyed approximately 2,500 individuals with upper limb loss [1]. When asked to identify specific features of their current myoelectric prostheses that needed improvement, the survey respondents overwhelmingly identified the lack of wrist and finger movement, as well as poor control capability. However, simply building a mechanism with individual finger and wrist motion is not enough. In the 1960's and 1970's, engineers built a number of more dexterous prosthetic hands. Unfortunately, these were rejected during clinical trials due to a difficult and distracting control interface. The goal of this project, "Applying Space Technology to Enhance Control of an Artificial Arm for Children and Adults with Amputations," was to lay the foundation for a multi-function, intuitive myoelectric control system which requires no conscious thought to move the hand. We built an extensive myoelectric signal database for six motions from ten amputee volunteers, We also tested a control system based on new

artificial intelligence techniques on the data from two of these subjects. This data is available to anyone doing myoelectric control research. Its availability is an important contribution to the prosthetics research community, as many researchers do not have access to amputee subjects. Since we collected myoelectric data from subjects' sound arms as well as their residual arms, this database will also prove useful to virtual reality and robotics researchers who want to explore myoelectric-based interfaces between any user and a machine. Currently, one small company (Intelligenta, Inc.) and one university (University of New Brunswick, Canada) are using this myoelectric database under other funding to develop multifunction control systems for prostheses. A prosthetics manufacturer (Liberty Technology, Inc.) is making plans to incorporate the results of their work into an artificial hand capable of several different movements to provide functionality only dreamed of by current myoelectric users. Methods Six adults and four children, all with unilateral, below-elbow amputations served as subjects. Five of the adults (3 male, 2 female, average age 34 years) had amputations due to traumatic injury, while one adult (female, age 32 years) and the four children (3 male, 1 female, average age 13 years) had congenital (i.e. from birth) limb deficiencies.
Derived from text
Prosthetic Devices; Control Equipment; Artificial Intelligence; Aerospace Engineering; Robotics; Controllability

19990025905 Department of Energy, Office of Environmental Restoration and Waste Management, Washington, DC USA
Modular Approach to Redundant Robot Control
Anderson, R. J., Department of Energy, USA; Dec. 31, 1997; 9p; In English; Robotics and Automation
Report No.(s): DE98-001676; SAND-97-3097C; CONF-970469; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This paper describes a modular approach for computing redundant robot kinematics. First some conventional redundant control methods are presented and shown to be 'passive control laws', i.e. they can be represented by a network consisting of passive elements. These networks are then put into modular form by applying scattering operator techniques. Additional subnetwork modules can then be added to further shape the motion. Modules for obstacle detection, joint limit avoidance, proximity sensing, and for imposing nonlinear velocity constraints are presented. The resulting redundant robot control system is modular, flexible and robust.
NTIS
Robot Control; Kinematics; Robot Dynamics; Redundancy

19990025910 Department of Energy, Office of Financial Management and Controller, Washington, DC USA
Implementing robotics in the Department of Energy Dismantlement Program
Jones, A. T., Department of Energy, USA; Dec. 31, 1997; 10p; In English; WAC 1998: World Automation Congress
Report No.(s): DE98-001261; SAND-97-2856C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Since the end of the cold war, as our nuclear stockpile has decreased, the Department of Energy (DOE) has been working rapidly to safely dismantle weapons returned by the military. In order to be retired, weapons must be returned to the Pantex Plant in Amarillo, Texas. There they are reduced to their component parts. Although many of these parts are not hazardous, some, including certain explosive assemblies and radioactive materials, are sufficiently hazardous so that special handling systems are necessary. This paper will describe several of these systems developed by Sandia for Pantex and their technical basis.
NTIS
Robotics; Nuclear Weapons

19990025941 Naval Postgraduate School, Monterey, CA USA
Multiple Robot Command and Control Architecture Development
Zachary, Uriah E.; Dec. 1998; 114p; In English
Report No.(s): AD-A359561; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The military use of autonomous vehicles or robots will increase as national security planners seek to maintain strategic deterrence and preserve U.S. interest in spite of reduced resources. Cooperative group behavior among large numbers of robots will be required to complete various missions. Communication schemes for command, control, and coordination of multiple robots is one of the required capabilities. This thesis evaluates the Simplified Lisp-like Expression Evaluation Paradigm (SLEEP) for implementation as a development tool and a communications scheme: SLEEP enables the dynamic group formation of robots that are best qualified for a task. The SLEEP concept is tested and evaluated using a testbed built from Nomadic SCOUT mobile robots and a socket interface. Results from simulation and physical experiments validate the effectiveness of SLEEP for multiple robot coordination.
DTIC
Command and Control; Robots; Group Dynamics; Robot Control; Autonomy

19990026129 Department of Energy, Office of Energy Research, Washington, DC USA
Proximity sensor system development:. CRADA *Final Report*
Haley, D. C., Department of Energy, USA; Pigoski, T. M., Department of Energy, USA; Dec. 31, 1998; 100p; In English
Report No.(s): DE98-051590; ORNL/M-6358; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Lockheed Martin Energy Research Corporation (LMERC) and Merritt Systems, Inc. (MSI) entered into a Cooperative Research and Development Agreement (CRADA) for the development and demonstration of a compact, modular proximity sensing system suitable for application to a wide class of manipulator systems operated in support of environmental restoration and waste management activities. In teleoperated modes, proximity sensing provides the manipulator operator continuous information regarding the proximity of the manipulator to objects in the workspace. In teleoperated and robotic modes, proximity sensing provides added safety through the implementation of active whole arm collision avoidance capabilities. Oak Ridge National Laboratory (ORNL), managed by LMERC for the USA Department of Energy (DOE), has developed an application specific integrated circuit (ASIC) design for the electronics required to support a modular whole arm proximity sensing system based on the use of capacitive sensors developed at Sandia National Laboratories. The use of ASIC technology greatly reduces the size of the electronics required to support the selected sensor types allowing deployment of many small sensor nodes over a large area of the manipulator surface to provide maximum sensor coverage. The ASIC design also provides a communication interface to support sensor commands from and sensor data transmission to a distributed processing system which allows modular implementation and operation of the sensor system. MSI is a commercial small business specializing in proximity sensing systems based upon infrared and acoustic sensors.
NTIS
Manipulators; Fabrication; Design Analysis; Remote Sensors; Research and Development; Data Transmission

19990026389 Department of Energy, Washington, DC USA
Tele-robotic/autonomous control using controlshell
Wilhelmsen, K. C., Department of Energy, USA; Hurd, R. L., Department of Energy, USA; Couture, S., Department of Energy, USA; Dec. 10, 1996; 11p; In English; 7th; Robotics and Remote Systems, USA; Sponsored by American Nuclear Society, USA
Report No.(s): DE98-050729; UCRL-JC-125880; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A tele-robotic and autonomous controller architecture for waste handling and sorting has been developed which uses telerobotics, autonomous grasping and image processing. As a starting point, prior work from LLNL and ORNL was restructured and ported to a special real-time development environment. Significant improvements in collision avoidance, force compliance, and shared control aspects were then developed. Several orders of magnitude improvement were made in some areas to meet the speed and robustness requirements of the application.
NTIS
Robots; Automatic Control; Image Processing; Real Time Operation; Robotics; Waste Treatment

19990026418 Department of Energy, Office of Financial Management and Controller, Washington, DC USA
Mobile robotics research at Sandia National Laboratories
Morse, W. D., Department of Energy, USA; Dec. 31, 1998; 10p; In English; Association of unmanned vehicle systems
Report No.(s): DE98-003500; SAND-98-1425C; CONF-980664; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Sandia is a National Security Laboratory providing scientific and engineering solutions to meet national needs for both government and industry. As part of this mission, the Intelligent Systems and Robotics Center conducts research and development in robotics and intelligent machine technologies. An overview of Sandia's mobile robotics research is provided. Recent achievements and future directions in the areas of coordinated mobile manipulation, small smart machines, world modeling, and special application robots are presented.
NTIS
Robotics; Artificial Intelligence; Robots

19990026451 Department of the Navy, Washington, DC USA
System and Method for Determining Node Functionality in Artificial Neural Networks
Deangelis, Christohper M., Inventor; Jul. 28, 1998; 8p; In English
Patent Info.: Filed 23 Aug. 96,; US-Patent-Appl-SN-702,300; US-Patent-5,787,408
Report No.(s): AD-D019171; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A system for unwrapping an artificial neural network (ANN) to determine the utilization and functionality of the nodes uses a network generator for generating an initial ANN architecture. Training and pruning processors operate to generate an initial

ANN architectures having increasingly lower levels of classification accuracy. A network analyzer uses an analysis controller to receive minimal ANN architectures from the pruning processor. A connection analyzer operates on the minimal ANN architectures to identify the inputs to the minimal ANN architecture and determine the information represented by and contained in the network inputs. A node analyzer. coupled to the connection analyzer. then defines the utilization and functionality of each node in the minimal ANN architecture in terms of known functions.
DTIC
Neural Nets; Accuracy; Classifications

19990026556 Department of the Navy, Washington, DC USA
Neural Network Architecture for Gaussian Components of a Mixture Density Function
Streit, Roy L., Inventor; Aug. 04, 1998; 9p; In English
Patent Info.: Filed 7 Jul. 95,; US-Patent-Appl-SN-499,245; US-Patent-5,790,758
Report No.(s): AD-D019180; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A neural network for classifying input vectors to an outcome class under the assumption that the classes are characterized by mixtures of component populations having a multivariate Gaussian likelihood distribution. The neural network comprises an input layer for receiving components of an input vector two hidden layers for generating a number of outcome class component values, and an output layer. The first hidden layer includes a number of first layer nodes each connected receive input vector components and generate a first layer output value representing the absolute value of the sum of a function of the difference between each input vector component and a threshold value. The second hidden layer includes a plurality of second layer nodes, each second layer node being connected to the first layer nodes and generating an outcome class component value representing a function related to the exponential of the negative square of a function of the sum of the first layer output values times a weighting value. The output layer includes a plurality of output nodes, each associated with an outcome class, for generating a value that represents the likelihood that the input vector belongs to that outcome class.
DTIC
Neural Nets; Architecture (Computers); Vector Analysis

19990026625 Department of the Navy, Washington, DC USA
Pilot Vehicle Which is Useful for Monitoring Hazardous Conditions on Railroad Tracks
Cooper, Guy, Inventor; Jul. 28, 1998; 48p; In English
Patent Info.: Filed 21 Feb. 97,; US-Patent-Appl-SN-804,348; US-Patent-5,786,750
Report No.(s): AD-D019188; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A self-propelled remotely controlled pilot vehicle adapted for use on railroad tracks to monitor hazardous conditions and obstacles on the railroad tracks. The pilot vehicle precedes a train along the railroad tracks at a distance which will allow the train to come to a complete stop in the event the pilot vehicle encounters a hazardous condition on the track. The pilot vehicle is equipped with a sensor array which measures a variety of different parameters such as the presence of noxious gases, moisture in the atmosphere, breakage in one or both rails of the track and orientation with respect to the force of gravity as well as the yaw, pitch and roll attitude of the tracks upon which the pilot vehicle is riding. The pilot vehicle is also equipped with a television camera which provides a visual image of the railroad track ahead of the pilot vehicle to the engineer of the train. An infrared camera which is mounted on the front of the pilot vehicle generates an infrared image of the tracks, information gathered by the pilot vehicle's sensor array is supplied to a computer on board the pilot vehicle and is also transmitted to the train to enable the engineer to be apprised of conditions existing on the tracks ahead of the train in order to have time to react to dangerous situations on the railroad tracks.
DTIC
Hazards; Rail Transportation; Infrared Imagery

19990026633 Department of the Navy, Washington, DC USA
High Order Fractal Feature Extraction for Classification of Objects in Images
Nelson, Susan R., Inventor; Tuovila, Susan M., Inventor; Jul. 28, 1998; 19p; In English; Supersedes US-Patent-Appl-SN-629709
Patent Info.: Filed 9 Apr. 96,; US-Patent-5,787,201; US-Patent-Appl-SN-629,709
Report No.(s): AD-D019250; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A method of identifying and classifying pre-detected target candidates in an image using pixel intensity and a fractalization process applied to the image. A raw analog image is digitized and normalized. The normalized pixel intensity content of the image is converted to fractal dimensions using a small and a large fractal box, sequentially. An array of special fractal features satisfying

predetermined classification thresholds is prepared from the fractal dimensions for each box centered about each pre-detected target candidate in the image, thus classifying the detected objects as targets.
DTIC
Pattern Recognition; Classifications; Analogs; Fractals

64
NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

19990025210 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China
A New Method for Factoring Matrix Polynomials Relative to the Unit Circle
Guo, Tong-Yi, National Kaohsiung Inst. of Tech., Taiwan, Province of China; Lin, Bo-Win, National Chung-Cheng Univ., Taiwan, Province of China; Hwan, Chyi, National Chung-Cheng Univ., Taiwan, Province of China; Journal of the Chinese Institute of Engineers: Transactions of the Chinese Institute of Engineers, Series A; January 1998; ISSN 0253-3839; Volume 21, No. 1, pp. 87-92; In English
Contract(s)/Grant(s): NSC-85-2214-E-151-001; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This paper presents a new method for factoring a self-inversive Hermitian matrix polynomial relative to the unit-radius circle. It formulates the factorization problem as that of evaluating a set of definite integrals along the unit circle and of solving a block-Toeplitz system of linear equations. Since the evaluation of definite integrals along the unit circle can be accomplished via parallel computations and the solution of a block-Toeplitz system can be obtained by a fast algorithm, the proposed method is very useful in real-time applications.
Author
Algorithms; Matrices (Mathematics); Polynomials; Integrals; Circles (Geometry); Factorization

19990025787 Department of Energy, Assistant Secretary for Nuclear Energy, Washington, DC USA
Problem decomposition and domain-based parallelism via group theoretic principles
Makai, M., Department of Energy, USA; Orechwa, Y., Department of Energy, USA; Oct. 31, 1997; 15p; In English; Mathematical methods and supercomputing in nuclear applications
Report No.(s): DE97-008618; ANL/RA/CP-92702; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

A systematic approach based on group theoretic principles, is presented for the decomposition of the solution algorithm of boundary value problems specified over symmetric domains, which is amenable to implementation for parallel computation. The principles are applied to the linear transport equation in general, and the decomposition is demonstrated for a square node in particular.
NTIS
Decomposition; Domains; Nuclear Physics; Group Theory; Parallel Processing (Computers)

19990026051 Northwestern Univ., College of Computer Science, Chicago, IL USA
An Efficient, Wavelet Based, Variable Structure Network
Tilbury, Chad A., Northwestern Univ., USA; Jun. 1998; 150p; In English
Report No.(s): AD-A358547; AFIT-98-095; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Learning systems, specifically neural networks trained using supervised learning, have become widely accepted and in many cases provide good approximations to the given target function. One of the parameters that tends to make a large difference in the output of the network is its size, or number of units that comprise the network. However, there is often no easy way to determine how large a network should be. A way to combat this problem is through a variable structure algorithm.
DTIC
Combat; Neural Nets; Wavelet Analysis

65
STATISTICS AND PROBABILITY

Includes data sampling and smoothing: Monte Carlo method; and stochastic processes.

19990026222 Department of Energy, Office of Energy Research, Washington, DC USA
Probabilistic lower bound for two-stage stochastic programs
Dantzig, G. B., Department of Energy, USA; Infanger, G., Department of Energy, USA; Nov. 30, 1995; 23p; In English
Report No.(s): DE98-006355; DOE/ER/25116-T3; SOL-95-6; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In the framework of Benders decomposition for two-stage stochastic linear programs, the authors estimate the coefficients and right-hand sides of the cutting planes using Monte Carlo sampling. The authors present a new theory for estimating a lower bound for the optimal objective value and they compare (using various test problems whose true optimal value is known) the predicted versus the observed rate of coverage of the optimal objective by the lower bound confidence interval.
NTIS
Stochastic Processes; Monte Carlo Method; Decomposition; Cutting

19990026266 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA
Exponential convergence with adaptive Monte Carlo
Booth, T. E., Department of Energy, USA; Nov. 30, 1997; 8p; In English; Sponsored by American Nuclear Society, USA
Report No.(s): DE97-009130; LA-UR-97-2402; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

For over a decade, it has been known that exponential convergence on discrete transport problems was possible using adaptive Monte Carlo techniques. Now, exponential convergence has been empirically demonstrated on a spatially continuous problem.
NTIS
Monte Carlo Method; Convergence; Problem Solving

19990026390 Department of Energy, Washington, DC USA
Monte Carlo simulation of scenario probability distributions
Glaser, R., Department of Energy, USA; Oct. 23, 1996; 27p; In English
Report No.(s): DE98-050727; UCRL-ID-125798; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Suppose a scenario of interest can be represented as a series of events. A final result R may be viewed then as the intersection of three events, A, B, and C. The probability of the result P(R) in this case is the product P(R) = P(A) P(B (vert-bar) A) P(C (vert-bar) A (intersection) B). An expert may be reluctant to estimate P(R) as a whole yet agree to supply his notions of the component probabilities in the form of prior distributions. Each component prior distribution may be viewed as the stochastic characterization of the expert's uncertainty regarding the true value of the component probability. Mathematically, the component probabilities are treated as independent random variables and P(R) as their product; the induced prior distribution for P(R) is determined which characterizes the expert's uncertainty regarding P(R). It may be both convenient and adequate to approximate the desired distribution by Monte Carlo simulation. Software has been written for this task that allows a variety of component priors that experts with good engineering judgment might feel comfortable with. The priors are mostly based on so-called likelihood classes. The software permits an expert to choose for a given component event probability one of six types of prior distributions, and the expert specifies the parameter value(s) for that prior. Each prior is unimodal. The expert essentially decides where the mode is, how the probability is distributed in the vicinity of the mode, and how rapidly it attenuates away. Limiting and degenerate applications allow the expert to be vague or precise.
NTIS
Monte Carlo Method; Probability Theory; Random Variables

66
SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

19990025838 Boeing North American, Inc., Downey, CA USA
What Do We Really Need for a Mars Mission?: Technology
Willenberg, Harvey J., Boeing North American, Inc., USA; HEDS-UP Mars Exploration Forum; 1998, pp. 225-228; In English; See also 19990025822; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

This presentation addresses the question of what technology do we really need for the Mars Mission. It also addresses how to achieve political and public support for these objectives. It is also important to know what the costs of the mission will be. The issues addressed are technical readiness, amongst these are Earth to Orbit transportation, space based transportation, Mars landing and ascent, and regenerative life support systems. The program needs and challenges are also addressed. This is presented as an outline.
CASI
Mars Landing; Mars Exploration; Politics; Cost Estimates; Manned Mars Missions

19990026042 Columbia Univ., New York, NY USA
Analytical Analysis of Vehicle Routing and Inventory Routing Problems ***Final Report***
Dec. 30, 1998; 6p; In English
Contract(s)/Grant(s): N00014-90-J-1649
Report No.(s): AD-A358629; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The objective of the project is to perform analytical analyses of heuristics for the Vehicle Routing Problem (VRP) and apply the results in models that integrate vehicle routing with other issues important to the firm. Our major accomplishments are: (1) Determined the exact structure of the asymptotic optimal solution value of the VRP with capacity and time window constraints and used it to develop a new and efficient algorithm. (2) Obtained a characterization of the effectiveness of set partitioning formulations for VRPs. (3) Characterized the worst case behavior of the linear programming relaxation of the set partitioning formulation for the bin packing problem. (4) Performed a probabilistic analysis of a multi-echelon distribution system and used the insight obtained to develop an efficient algorithm for it.
DTIC
Heuristic Methods; Linear Programming

19990026291 Naval Postgraduate School, Monterey, CA USA
Vision Guidance Controller for an Unmanned Aerial Vehicle
Watson, Mark T.; Dec. 1998; 94p; In English
Report No.(s): AD-A359702; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The use of Unmanned Aerial Vehicles (UAVs) in modern military operations for reconnaissance and other missions continues to grow. UAV systems using remote control guidance are limited in range and subject to Electronic Warfare concerns. Guidance Systems using only Global Positioning Service (GPS) or an Inertial Navigation System (INS) are limited to a pre-programmed route of flight. A vision guidance system that can control the UAV over an arbitrary course is not subject to these limitations. This thesis uses classical control methods to develop and test an autonomous vision controller for the FOG-R UAV (FROG). First, a computer model of the camera output for a flight that tracks a river is made to develop the controller and to test it in nonlinear simulation. Finally, the complete system is flight tested on the FROG UAV. The design and test equipment include a highly modified FOG-R UAV from the U.S. Army, the MATRIXx Product Family of software tools developed by Integrated Systems, Inc., and a Ground Station built at NPS from commercially available computer and communication equipment.
DTIC
Controllers; Global Positioning System; Interprocessor Communication; Pilotless Aircraft; Remote Control; Military Operations; Nonlinear Systems

67
THEORETICAL MATHEMATICS

Includes topology and number theory.

19990025957 Naval Postgraduate School, Monterey, CA USA
Mathematical Modeling Using MATLAB
Phillips, Donovan D.; Dec. 1998; 132p; In English
Report No.(s): AD-A358796; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Mathematical modeling forms a bridge between the study of mathematics and the application of mathematics with the intent of explaining or predicting real world behavior. In their book A First Course in Mathematical Modeling, Frank R. Giordano, Maurice D. Weir, and William P. Fox provide an introduction to the entire modeling process. Model verification, an important step(in the modeling process, often requires the analysis of vast amounts of data, making computational support essential. Mathematical Modeling Using MA MATLAB acts as a companion resource to A First Course in Mathematical Modeling with the goal of guiding the reader to a fuller understanding of the modeling process through the employment of MATLAB's powerful computational capabilities. In it, the reader is led through a series of examples, each building upon the previous, which apply MATLAB's computational power to various modeling scenarios. While not intended as a text in modeling, Mathematical Modeling Using MA TIAB is a useful resource for the novice modeler interested in tackling problems too large to be performed manually.
DTIC
Computer Systems Performance; Computer Techniques; Mathematical Models; Predictions

19990026113 Tel-Aviv Univ., Ramat-Aviv, School of Mathematical Sciences, Tel-Aviv, Israel
Fourth International Conference on Spectral and High Order Methods
Jun. 1998; 212p; In English, 22-26 Jun. 1998, Herzliya, Israel
Contract(s)/Grant(s): F61775-98-WE048
Report No.(s): AD-A359589; EOARD-CSP-98-1049; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche; Abstracts Only; Abstracts Only

The Final Proceedings for Fourth International Conference on Spectral and High Order Methods, 22 June 1998 - 26 June 1998. This is an interdisciplinary conference. Topics include theoretical, applied, and computational aspects of high order and spectral methods. Specific subjects to be addressed include spectral methods, high order finite difference and finite element methods, and wavelet-based methods for the solution of partial differential equations. Applications to be considered include electromagnetics, fluid and structural dynamics problems, efficient solvers for high order methods, and parallel aspects of spectral and high order methods.
DTIC
Conferences; Finite Difference Theory; Finite Element Method; Spectral Methods; Partial Differential Equations

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PHYSICS (GENERAL)

For precision time and time interval (PTTI) see 35 Instrumentation and Photography; for geophysics, astrophysics or solar physics see 46 Geophysics, 90 Astrophysics, or 92 Solar Physics.

19990025213 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China
Nonlinear Vibration Analysis of a Traveling String with Time-Dependent Length by Finite Element Method
Fung, Rong-Fong, Chung Yuan Univ., Taiwan, Province of China; Wang, Pao-Hsii, Chung Yuan Univ., Taiwan, Province of China; Lee, Ming-Jer, Chung Yuan Univ., Taiwan, Province of China; Journal of the Chinese Institute of Engineers: Transactions of the Chinese Institute of Engineers, Series A; January 1998; ISSN 0253-3839; Volume 21, No. 1, pp. 109-117; In English
Contract(s)/Grant(s): NSC-84-2212-6033-002; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

In this paper, the nonlinear vibrations of string with time-varying length and a weight at one end are investigated. A set of nonlinear, time-varying differential equations describing this system was derived by using Hamilton's principle. An approximated model was made by variable-domain finite element formulation. Numerical results are presented for the parabolic and sinusoidal axial-motions of the string. Finally, the linear and nonlinear effects on the transient amplitudes are also compared.
Author
Finite Element Method; Differential Equations; Strings; Time Dependence; Elastic Media; Wave Propagation; Vibration Measurement

19990025261 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
The Use of Complex Stiffnesses for Hysteretic Damping ***Final Report, Apr. 1998 - pr. 98-***
Dec. 1998; 23p; In English
Report No.(s): AD-A359327; ARL-TR-1856; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This technical treatise has exemplified a response spectrum method that is particularly suited for spring-mass-damping systems excited by one or more base or ground disturbances characterized by displacements. It offers an alternative to the conventional response spectrum method, which is best suited for a single prescribed ground acceleration. This methodology has also introduced a method of how to incorporate hysteretic damping through complex spring stiffness. When the formulation is expressed via base displacements, a simpler application of the response spectrum method to varying spring-mass systems with attendant input excitations can be realized as expressed as the ratio of energy considerations inherent in the natural physics of the phenomena itself.

DTIC

Hysteresis; Damping; Stiffness; Excitation

19990025578 Lodz Univ., Textile Inst., Poland
Dielectric and Related Phenomena
Nov. 14, 1996; 137p; In English; 4th, USA
Contract(s)/Grant(s): F61708-96-W-0295
Report No.(s): AD-A358905; EOARD-CSP-96-1056; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The Final Proceedings for The Fourth International Conference on Dielectric and Related Phenomena, 16 September 1996 - 20 September 1996 relaxation theory; dielectric response characterization; molecular dynamics; smart dielectrics; polymer-ceramic structures; non-linear optical materials; ferro and antiferro-electric materials; dielectric relaxation phenomena in polymers; liquid crystal.

DTIC

Conferences; Dielectrics; Molecular Dynamics; Ceramics

19990025763 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
Conduction in Electrically Exploded Wires of Nonuniform Diameters ***Final Report***
Hollandsworth, Clinton E.; Powell, John D.; Keele, Michael J.; Hummer, Charles R.; Dec. 1998; 50p; In English; Original contains color plates
Report No.(s): AD-A358916; ARL-TR-1773; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Recent work by Me-Bar and Harel, intended to characterize the conduction characteristics of exploding segmented wires, is extended. A set of experiments on conductors composed of various materials and in various geometries was undertaken. The experimental work is complemented by two-dimensional calculations in which the magnetic diffusion equation is solved for the problems at hand. Results from these calculations are used to explain the behavior observed in the experiments. It is also observed from the calculations that different results for segmented wires might be obtained if the plasma, resulting from partial explosion of the wires, is confined radially around the wire. A set of experiments to test this contention was undertaken and produced results in good qualitative agreement with the theoretical predictions. Physical reasons for the observed behavior, as well as possible methods for ameliorating undesired effects, are indicated.

DTIC

Magnetic Diffusion; Plasmas (Physics); Exploding Wires; Explosions

19990026531 National Inst. for Fusion Science, Nagoya, Japan
Papers Presented at the 6th H-Mode Workshop
Oct. 1997; ISSN 0915-633X; 25p; In English; 6th; H-Mode, 22-24 Sep. 1997, Kloster Seeon, Germany; See also 19990026532 through 19990026536
Report No.(s): NIFS-516; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The 6th H-mode workshop was held at Kloster Seeon (Germany) during the period of September 22-24, 1997. Contribution to this workshop is reported. Reports include: Role of Nonuniform Superthermal Ions for Internal Transport Barriers; Electric Field Bifurcation and Transition in the Core Plasma of CHS; Formation and Termination of High Ion Temperature Mode in Heliotron/torsatron Plasmas; Transition to an Enhanced Internal Transport Barrier; and Physics of Collapses - Probabilistic Occurrence of ELMs and Crashes.

Author

Conferences; Research and Development

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ACOUSTICS

Includes sound generation, transmission and attenuation. For noise pollution see 45 Environmental Pollution.

19990025472 Naval Research Lab., Marine Geosciences Div., Stennis Space Center, MS USA
Sediment Characterization and Mapping Using High Frequency Acoustic and Core Data in the Chesapeake Bay
Walter, D. J., Naval Research Lab., USA; Lambert, D. N., Naval Research Lab., USA; Young, D. C., Naval Research Lab., USA; Nov. 1998; 8p; In English
Report No.(s): AD-A358753; NRL/PP/7431--98-0005; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Several locations in the Chesapeake Bay were surveyed with an acoustic seafloor classification system to characterize and delineate areal distribution of surficial sediment properties. Predictions of acoustic impedance using this system provide a capability for initial assessment and prediction of sediment properties during the survey. Color-coded trackline maps created in real-time on a computer monitor represent estimated surficial sediment fades type and location. Analyses of the color-coded maps reveal a diversity of sediment types and distribution at each site and between sites. Thick sediment coverings are predominantly fine grained as identified by low intensity acoustic returns. Thin coverings consist of more dense, granular materials and are identified by higher intensity acoustic returns. Two locations south of the mouth of the Patuxent River and one near the mouth of the Choptank River consist primarily of fine and medium silts to silty clays. These sizes exhibit the lowest impedance levels on the trackline maps. Samples collected at one site slightly inside, and three sites north, of the mouth of the Patuxent River are composed of more dense, granular sands. Higher predicted impedance on the maps are indicative of dense sediments. Acoustically derived impedance predictions have been gridded and contoured to create a color-coded sediment facies province map at one of the sites. This province map provides a representation of relative sediment type and distribution at this site.
DTIC
Sediments; Acoustic Impedance; Acoustic Properties; Mapping

19990025650 JWR, Inc., Albuquerque, NM USA
Air Blast Propagation into Acoustic Shadow Zones ***Final Report***
Reed, J. W.; Jul. 31, 1998; 39p; In English
Contract(s)/Grant(s): N00174-98-M-0177
Report No.(s): AD-A359295; NSWC-IH-CR-98-67; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Open burn-open detonation rocket motor disposal explosions conducted at the Utah Test and Training Range of Hill Air Force Base are delayed until proper weather conditions are present. These nominal conditions are an eastward-directed sound velocity versus height gradient that refracts airblast upward, away from the ground. Such weather conditions generally attenuate airblasts propagated at ground level, cause minimal disturbance to their neighborhoods, and are usually acceptable to explosion testers. These types of noise propagations have, thus, been mostly ignored in studies of nuisance airblast propagations. However, there are some cases where attenuated propagations shadowed either by atmospheric refraction effects or by terrain barriers can be of concern. Consequently, this paper attempts to develop a better understanding of wave diffraction, scattering, or diffusion into such shadow zones.
DTIC
Acoustic Velocity; Aerial Explosions; Atmospheric Refraction; Rocket Engines; Scattering; Velocity Distribution; Wave Diffraction

19990025952 NASA Lewis Research Center, Cleveland, OH USA
Subsonic Jet Noise from Non-Axisymmetric and Tabbed Nozzles
Tam, Christopher K. W., Florida State Univ., USA; Zaman, K. B. M. Q., NASA Lewis Research Center, USA; 1999; 13p; In English; 37th; Aerospace Sciences, 11-14 Jan. 1999, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAG3-2102; NAG1-1776
Report No.(s): AIAA Paper-99-0077; Copyright; Avail: Issuing Activity (American Inst. of Aeronautics and Astronautics, 1801 Alexander Bell Dr., Suite 500, Reston, VA 20191), Hardcopy, Microfiche

Subsonic jet noise from non-axisymmetric and tabbed nozzles are investigated experimentally and theoretically. It is shown that the noise spectra of these jets are in good agreement with the similarity spectra found empirically earlier by Tam, Golebiowski and Seiner through a detailed analysis of supersonic jet noise data. Further, the radiated noise fields of the jets under study, including elliptic and large aspect ratio rectangular jets, are found to be quite axisymmetric and are practically the same as that of a circular jet with the same exit area. These experimental results strongly suggest that nozzle geometry modification into elliptic or

rectangular shapes is not an effective method for jet noise suppression. A lobed nozzle, on the other hand, is found to significantly impact the noise field. Noise from large scale turbulent structures, radiating principally in the downstream direction, is effectively suppressed. Tabs also impact the noise field, primarily by shifting the spectral peak to a higher frequency. A jetlets model is developed to provide a basic understanding of the noise from tabbed jets. The model predicts that the noise spectrum from a jet with N tabs (N greater than or equal to 2) can be obtained from that of the original jet (no tab) by a simple frequency shift. The shifted frequency is obtained by multiplying the original frequency by N(exp 1/2). This result is in fairly good agreement with experimental data.
Author
Subsonic Flow; Tabs (Control Surfaces); Aerodynamic Noise; Jet Aircraft Noise; Engine Noise; Noise Spectra; Nozzle Flow

19990026044 Army Research Lab., Sensors Directorate, Adelphi, MD USA
Acoustic Target Classification Using Multiscale Methods
Eom, K., George Washington Univ., USA; Wellman, M., Army Research Lab., USA; Srour, N., Army Research Lab., USA; Hillis, D., Army Research Lab., USA; Chellappa, R., Maryland Univ., USA; Jan. 1998; 5p; In English
Report No.(s): AD-A358579; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This study considers the classification of acoustic signatures using features extracted at multiple scales from hierarchical models and a wavelet transform, In the model based approach; multiscale spectral features are extracted with hierarchical autoregressive and moving average (ARMA) models. The modeling approach is also used for monitoring vehicular activities from an AR spectrogram. The AR spectrogram shows engine speed; gear changes; and other vehicular activities well; because it represents dominant spectral peaks better than a short time Fourier transform. In the wavelet transform based approach; multiscale features are obtained with a wavelet transform. Multiscale classification methods were applied to acoustic data collected at different test tracks under various testing conditions. In this experiment; about 92 percent of vehicles were correctly identified.
DTIC
Acoustic Properties; Autoregressive Moving Average; Fourier Transformation; Spectrograms; Wavelet Analysis

19990026095 Naval Research Lab., Marine Geosciences Div., Stennis Space Center, MS USA
Time-Frequency Analysis of Acoustic Imagery for Bottom Mapping
Kalcic, Maria T.; Martinez, Andrew B.; Lambert, Douglas N.; Nov. 1998; 7p; In English; Prepared in cooperation with Tulane Univ., EECS Dept., New Orleans, LA.
Report No.(s): AD-A358755; NRL/PP/7441--98-0009; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Acoustic imagery generated by the Naval Research Laboratory's ASCS (Acoustic Sediment Classification System) is analyzed using time-frequency methods. The ASCS Imagery is generated using normal-incidence acoustic data. Nonlinearities in the propagating medium produce multiple harmonics in the return. Different components of the bottom and sub-bottom produce different spectral signatures, based on the harmonics that can be used to classify the bottom. Although the exact acoustic properties of the media may not be known, it is possible to segment the spectrally different components. This paper presents an efficient method for performing the time-frequency analysis. The tradeoffs between time and frequency resolution are examined and exploited to produce the best overall resolution. Examples using the ASCS data demonstrate its use for classification of acoustic imagery. Buried pipes, methane gas deposits, and other features can be differentiated using this method.
DTIC
Acoustic Properties; Spectral Signatures; Temporal Resolution; Classifications

19990026295 Boeing Co., Mesa, AZ USA
A User's Manual for ROTTILT Solver: Tiltrotor Fountain Flow Field Prediction
Tadghighi, Hormoz, Boeing Co., USA; Rajagopalan, R. Ganesh, Iowa State Univ. of Science and Technology, USA; January 1999; 88p; In English
Contract(s)/Grant(s): NAS1-20096; RTOP 576-03-14-10
Report No.(s): NASA/CR-1999-208973; NAS 1.26:208973; L9KVJC-FR-98001; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

A CFD solver has been developed to provide the time averaged details of the fountain flow typical for tiltrotor aircraft in hover. This Navier-Stokes solver, designated as ROTTILT, assumes the 3-D fountain flowfield to be steady and incompressible. The theoretical background is described in this manual. In order to enable the rotor trim solution in the presence of tiltrotor aircraft components such as wing, nacelle, and fuselage, the solver is coupled with a set of trim routines which are highly efficient in CPU and suitable for CFD analysis. The Cartesian grid technique utilized provides the user with a unique capability for insertion or elimination of any components of the bodies considered for a given tiltrotor aircraft configuration. The flowfield associated with

either a semi or full-span configuration can be computed through user options in the ROTTILT input file. Full details associated with the numerical solution implemented in ROTTILT and assumptions are presented. A description of input surface mesh topology is provided in the appendices along with a listing of all preprocessor programs. Input variable definitions and default values are provided for the V22 aircraft. Limited predicted results using the coupled ROTTILT/WOPWOP program for the V22 in hover are made and compared with measurement. to visualize the V22 aircraft and predictions, a preprocessor graphics program GNUPLOT3D was used. This program is described and example graphic results presented.
Author
User Manuals (Computer Programs); Computational Fluid Dynamics; Rotors; Flow Distribution; Computational Grids; Aircraft Configurations

19990026615 Naval Postgraduate School, Monterey, CA USA
Shallow Water Acoustic Variability and Influences on Autocorrelation Matching Localization Algorithms
Correa, Arthur F.; Dec. 1998; 66p; In English
Report No.(s): AD-A359854; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

In this work, several algorithms based on higher-order moment (autocorrelation) matching of single hydrophone element data have been developed and tested on real transient data sets. of particular interest is the success and robustness of the Frequency-Domain Autocorrelation Matching (FACM) algorithms in the presence of environmental mismatch, signal mismatch, and noise, for different signals in an unknown environment. Recently acquired data was analyzed for signal variability in terms of spatial coherence of phones, beams, and modal structure. The ability to localize using these higher-order moment matching algorithms was compared to the spatial structure of the signal, the placement of the receiving elements, and the signal variability. This work suggests that the FACM algorithms are strongly dependent on the source-receiver relative positions, and on the uniqueness of the signal vertical structure. It is also shown that their performance increases with the number of multipath arrivals and, therefore, with the range. More importantly, the localization results obtained with raw linear frequency modulated (LFM) signals seemed to be as useful as the ones obtained from matched-filtered data.
DTIC
Algorithms; Underwater Acoustics; Signal Processing; Shallow Water; Hydrophones; Autocorrelation

72
ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure, electron properties, and molecular spectra.

19990025928 Georgia Inst. of Tech., School of Physics, Atlanta, GA USA
Analysis and Visualization of Simulated Dynamics in Complex Materials Systems ***Final Report, 1 Mar. 1997 - 28 Oct. 1998***
Landman, Uzi; Nov. 23, 1998; 5p; In English
Contract(s)/Grant(s): F49620-97-1-0137
Report No.(s): AD-A359444; AFRL-SR-BL-TR-99-0016; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The objective of this grant was to enable and enhance research and educational capabilities pertaining to analysis and visualization of computer-based simulations of materials systems, through the acquisition of computer equipment and associated software for processing, analysis, visualization and animation of molecular dynamics simulation.
DTIC
Computerized Simulation; Molecular Structure; Complex Systems

19990025997 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA
Advances in the determination of quark masses
Bhattacharya, T., Department of Energy, USA; Gupta, R., Department of Energy, USA; Mar. 31, 1998; 16p; In English; 15th; Lattice field theory (Lattice-15)
Report No.(s): DE98-003449; LA-UR-97-4355; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Significant progress has been made in the determination of the light quark masses, using both lattice Quantum Chromodynamics (QCD) and sum rule methods, in the last year. The authors discuss the different methods and review the status of current results. Finally, they review the calculation of bottom and charm masses.
NTIS
Quantum Chromodynamics; Quarks; Mass

19990026002 Department of Energy, Office of Energy Research, Washington, DC USA

Cold-moderator scattering kernel methods

MacFarlane, R. E., Department of Energy, USA; Dec. 31, 1998; 11p; In English

Report No.(s): DE98-003681; LA-UR-98-655; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

An accurate representation of the scattering of neutrons by the materials used to build cold sources at neutron scattering facilities is important for the initial design and optimization of a cold source, and for the analysis of experimental results obtained using the cold source. In practice, this requires a good representation of the physics of scattering from the material, a method to convert this into observable quantities (such as scattering cross sections), and a method to use the results in a neutron transport code (such as the MCNP Monte Carlo code). At Los Alamos, the authors have been developing these capabilities over the last ten years. The final set of cold-moderator evaluations, together with evaluations for conventional moderator materials, was released in 1994. These materials have been processed into MCNP data files using the NJOY Nuclear Data Processing System. Over the course of this work, they were able to develop a new module for NJOY called LEAPR based on the LEAP + ADDELT code from the UK as modified by D.J. Picton for cold-moderator calculations. Much of the physics for methane came from Picton's work. The liquid hydrogen work was originally based on a code using the Young-Koppel approach that went through a number of hands in Europe (including Rolf Neef and Guy Robert). It was generalized and extended for LEAPR, and depends strongly on work by Keinert and Sax of the University of Stuttgart. Thus, their collection of cold-moderator scattering kernels is truly an international effort, and they are glad to be able to return the enhanced evaluations and processing techniques to the international community. In this paper, they give sections on the major cold moderator materials (namely, solid methane, liquid methane, and liquid hydrogen) using each section to introduce the relevant physics for that material and to show typical results.

NTIS

Cold Neutrons; Moderators; Kernel Functions; Neutron Scattering

19990026007 Department of Energy, Office of Energy Research, Washington, DC USA

Resonant multiphoton ionization spectra of molecules and molecular fragments ***Annual Report, Oct. 1987 - Sep. 1988***

Dec. 31, 1988; 13p; In English

Report No.(s): DE98-006381; DOE/ER/60513-T10; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The objective of the research under this contract is to carry out studies of resonant enhanced multiphoton ionization (REMPI) processes in molecules. In the (n+1)-REMPI process of interest an atom or molecule in a specific initial state absorbs n photons making a transition to an intermediate state from which it is subsequently ionized by absorption of an additional photon. The studies are designed to provide a quantitatively robust analysis and prediction of key spectral features in several ongoing experimental studies and potentially practical applications of this technique. The specific problems of interest to the authors in these studied are (1) the vibrational distributions of ions that can be expected in REMPI of small molecules and molecular fragments with particular emphasis on their non-Franck-Condon behavior. Such non-Franck-Condon behavior introduces serious complications in the use of the technique for state- specific production of ions, e.g., O(sub 2)(sup +)((nu)) and OH(sup +)((nu)), and in the extraction of state populations from REMPI signals, (2) rotational distributions of ions that can be produced in various REMPI schemes and how these distributions can be tuned by choice of the resonant state and influenced by the molecular character of the photoelectron, and (3) the circular dichroism in photoelectron angular distributions, i.e., the difference in photoelectron angular distributions produced by right- and left-circularly polarized, and their use as a probe of molecular alignment. Here the author will summarize the progress that has been made to date in the studies of these features and applications of REMPI of molecules and molecular fragments. A significant feature of these studies, which will be explicitly assumed throughout the discussion below, is that they are carried out using quantitatively reliable molecular photoelectron orbitals.

NTIS

Ionization; Research; Resonance; Molecules; Photoelectrons; Multiphoton Absorption

19990026008 Department of Energy, Office of Energy Research, Washington, DC USA

Research program in neutrino physics, cosmic rays and elementary particles: Task A ***Progress Report***

Reines, F., Department of Energy, USA; Sobel, H. W., Department of Energy, USA; Aug. 31, 1991; 152p; In English

Report No.(s): DE98-006382; DOE/ER/71019-T2; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Physics interests of the group are focused primarily on tests of conservation laws and studies of fundamental interactions between particles. There is also a significant interest in astrophysics and cosmic rays. Task A consists of three experimental programs; a Double-Beta Decay study (currently at the Hoover Dam), a Reactor Neutrino program (until this year at Savannah River), and the IMB Proton Decay experiment in a Cleveland salt mine. Discussion of the research in each area is given.

NTIS

Research; Neutrinos; Cosmic Rays; Elementary Particles

19990026010 Department of Energy, Office of Energy Research, Washington, DC USA

Precision measurements of charmonium states formed in (anti p)p annihilation

Armstrong, T. A., Department of Energy, USA; Bettoni, D., Department of Energy, USA; Bharadwaj, V., Department of Energy, USA; Aug. 31, 1991; 18p; In English

Report No.(s): DE98-006386; DOE/ER/71019-T3-PT.4; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Fermilab experiment E-760 studies the resonant formation of Charmonium states in proton-antiproton interactions using a hydrogen gas-jet target in the antiproton Accumulator ring at Fermilab. Precision measurements of the mass and width of the Charmonium states, (chi)(sub 1), (chi)(sub 2) and a new measurement of the (psi) mass are presented.

NTIS

Particle Production; Electromagnetic Measurement; Annihilation Reactions; Antiprotons; Elementary Particle Interactions; Protons; Research

19990026064 Department of Energy, Office of Energy Research, Washington, DC USA

Hadron production in light and heavy, quark and antiquark jets

Baird, K. G., Department of Energy, USA; Aug. 31, 1996; 15p; In English

Report No.(s): DE97-009097; SLAC-PUB-7271; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors review four hadronization studies performed by the SLD experiment at SLAC, involving separation of light (Z(0) yields u(anti-u), d(anti-d), s(anti-s)), c, and b flavors using precision vertexing, and separation of q- and (anti-q)-jets using the highly polarized SLC electron beam. They measured the differences between the average charged multiplicities in Z(0) yields light, yields c(anti-c), and yields b(anti-b) events, and found that the results were consistent with predictions of perturbative QCD. Next, they measured pi/(Kappa)/p/Kappa(0)/Lambda(0) production in light events for the first time, and compared with production in c- and b-flavor events. They then examined particle production differences in light quark and antiquark hemispheres, and observed more high momentum baryons and K(sup (minus))'s than antibaryons and K(+)'s in quark hemispheres, consistent with the leading particle hypothesis. Lastly, they performed a search for jet handedness in light q- and (anti q)-jets. Assuming Standard Model values of quark polarization in Z(0) decays, they have set an improved upper limit on the analyzing power of the handedness method.

NTIS

Particle Production; High Energy Interactions; Particle Decay; Quantum Chromodynamics; Hadrons; Quarks

19990026066 Department of Energy, Office of Energy Research, Washington, DC USA

D-Zero luminosity monitor constant for radical-s = 630 GeV

Krane, J., Department of Energy, USA; Barnly, J., Department of Energy, USA; Owen, D., Department of Energy, USA; Jun. 30, 1997; 15p; In English

Report No.(s): DE97-053692; FNAL-TM-2000; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

D0 has calculated the luminosity monitor constant for radical-s = 630 GeV. The inelastic p(anti p) cross section was interpolated between measurements performed at radical-s = 546 and 1800 GeV. The geometric acceptance, hardware efficiency, and luminosity-dependent corrections are similar to those previously published for the full Tevatron energy. We find a luminosity-weighted value of sigma(sub L0) = 34.04 +/- 1.05 mb, yielding a precision of +/- 3.08%.

NTIS

Elementary Particle Interactions; Luminosity

19990026139 Department of Energy, Office of Energy Research, Washington, DC USA

Charmonium and charm decays from the Fermilab fixed target program

Cheung, G. W. K., Department of Energy, USA; May 31, 1998; 9p; In English; 33rd; Rencontres de moriond, QCD and high energy hadronic interactions

Report No.(s): DE98-054138; FNAL/C-98/142; CONF-980357; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Recent results on charm decay physics from the Fermilab Fixed Target program are presented. There have been many physics results within the past year from experiments E687 and E791 and these are highlighted. Many of these results are related to rare phenomena and searches. These become even more interesting with the FOCUS experiment dataset of 1 million fully recon-

structed charm decays. Preliminary signals from FOCUS as well as from SELEX are presented together with prospects for the future. Preliminary results from E835 on the (eta)'(sub c) search are also presented.
NTIS
Charm (Particle Physics); Particle Decay

19990026140 Department of Energy, Office of Energy Research, Washington, DC USA
Progress toward a Km-scale neutrino detector in the deep ocean
Stokstad, R. G., Department of Energy, USA; Nov. 30, 1997; 12p; In English; 19th; Course of the Erice school on nuclear physics: neutrinos in astro, particle and nuclear physics
Report No.(s): DE98-054172; LBNL-41083; CONF-9709213; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The best particles for observing distant objects are photons and neutrinos. Because of the neutrino's weak interaction cross section, detectors suitable for astronomy must be very large and well shielded from cosmic rays. Eventually, a detector with the order of a square km of effective area will be needed for systematic observations of distant point sources such as active galactic nuclei. Prototype detectors are currently being developed at several sites in the ocean, at Lake Baikal, and in Antarctica. This talk summarizes the status of the projects that use the deep ocean for the detector medium and shielding: DUMAND, NESTOR and ANTARES. Technical developments are needed for a future km-scale detector; progress on one of these, a digital electronic system, is also described.
NTIS
Neutrinos; Oceans; Radiation Detectors

19990026146 Department of Energy, Office of Energy Research, Washington, DC USA
Observation of Z decays to b quark pairs at the Tevatron Collider
Dorigo, T., Department of Energy, USA; Jul. 31, 1998; 14p; In English; 29th; ICHEP 1998: high-energy physics
Report No.(s): DE98-057365; FNAL/C-98/197-E; CONF-980748; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A search for Z boson decays to pairs of b-quark jets has been performed in the full dataset collected with the Collider Detector at Fermilab (CDF) detector at the Tevatron p(anti p) collider. After the selection of a pure sample of b (anti b) events by means of the identification of secondary vertices from b-quark decays, we have used two kinematic variables to further discriminate the electroweak b (anti b) production from Quantum Chromodynamics (QCD) processes, and sought evidence for the Z decay in the dijet invariant mass distribution. An absolute background prediction allows the extraction of an excess of events inconsistent with the background predictions by 3.23(sigma) but in good agreement with the amount and characteristics of the expected signal. We then fit the mass distribution with an unbinned likelihood technique, and obtain a Z yields b (anti b) signal amounting to 91 +/- 30 +/- 19 events.
NTIS
Quarks; Particle Decay

19990026151 Department of Energy, Office of Energy Research, Washington, DC USA
K(sub s) K(sub s) System at 800 GeV/c
Reyes, M. A., Department of Energy, USA; Others,, Department of Energy, USA; Dec. 31, 1997; 6p; In English; 7th; Hadron 1997: Hadron spectroscopy
Report No.(s): DE98-057558; FNAL/C-97/407-E; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Results are presented from a partial wave analysis of a sample of centrally produced mesons in the reaction pp yields p(sub slow) K(sub s) K(sub s) p(sub fast) , with 800 GeV/c protons incident on a liquid hydrogen target. The meson system is found to be predominantly S-wave in the mass range between K(sub s) K(sub s) threshold and 1.58 GeV/c(sup 2) . The f(sub 0)(1500) is clearly observed in this region. Above 1.58 GeV/c(sup 2) two solutions are possible, one with mainly S-wave and another with mainly D-wave. This ambiguity prevents a unique determination of the spin of the f(sub J) (1710) meson.
NTIS
Liquid Hydrogen; Protons; Kaons

19990026211 Department of Energy, Office of Energy Research, Washington, DC USA
DIRC, a new type of particle identification system for BABAR
Schwiening, J., Department of Energy, USA; Dec. 31, 1997; 16p; In English; 5th; Physics in Hadron Machines, Unknown
Report No.(s): DE98-059174; SLAC-PUB-7715; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The DIRC, a new type of Cherenkov imaging device, has been selected as the primary particle identification system for the BABAR detector at the asymmetric B-factory, PEP-II. It is based on total internal reflection and uses long, rectangular bars made from synthetic fused silica as Cherenkov radiators and light guides. In this paper, the principles of the DIRC ring imaging Cherenkov technique are explained and results from the prototype program are presented. The studies of the optical properties and radiation hardness of the quartz radiators are described, followed by a discussion of the detector design.
NTIS
Silica Glass; Cerenkov Counters; Storage Rings (Particle Accelerators); Mesons; Quartz

19990026215 Department of Energy, Office of Energy Research, Washington, DC USA
Resonance Interference and Absolute Cross Sections in Near-Threshold Electron-Impact Excitation of Multicharged Ions
Bannister, M., Department of Energy, USA; Chung, Y. S., Department of Energy, USA; Djuric, N., Department of Energy, USA; Wallbank, B., Department of Energy, USA; Woitke, O., Department of Energy, USA; Sep. 30, 1997; 6p; In English; 20th; Physics of electronic and atomic collisions and exhibition
Report No.(s): DE97-008899; ORNL/CP-94782; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Strong resonance features were observed in near-threshold excitation of S-1 right arrow P-3 intercombination transitions in Si(2+), Ar(6+), and Kr(6+). Such resonances are predicted to dominate over direct excitation by more than an order of magnitude in the threshold region. Absolute cross sections were measured by using the merged electron-ion beams energy loss technique. The results are compared with R-matrix close-coupling (CCR) theory for all of the ions. Several discrepancies in resonance positions and magnitudes exist between experiment and theory for these spin forbidden transitions.
NTIS
Electron Impact; Excitation; Resonance; Ions; Ionization Cross Sections

19990026232 Rutherford Appleton Lab., Chilton, UK
Spin Correlations in e(+)e(-) Yields 4 Jets
Moretti, S., Rutherford Appleton Lab., UK; Stirling, W. J., Durham Univ., UK; Sep. 11, 1998; ISSN 1358-6254; 33p; In English
Report No.(s): RAL-TR-1998-037; DTP/98/32; Cavendish-HEP-97/12; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11, 0QX, UK), Hardcopy, Microfiche
Existence of discrepancies between experimental data and Monte Carlo predictions for angular distributions in four-jet production via e(+)e(-) annihilation has been known for some time at LEP1. As such QCD(Quantum Chromodynamics) processes constitute significant backgrounds to e(+)e(-) yields W(+)W(-) yields 4-jet production at LEP2, we consider the possibility that an erroneous modelling of the helicity structure of the final-state partons could affect the accuracy of experimental measurements of the W(+/-) boson parameters.
Author
Correlation; Electron-Positron Pairs; Electron Spin

19990026237 Department of Energy, Office of Energy Research, Washington, DC USA
Neutron scattering instruments for the Spallation Neutron Source (SNS)
Crawford, R. K., Department of Energy, USA; Fornek, T., Department of Energy, USA; Herwig, K. W., Department of Energy, USA; Dec. 31, 1998; 6p; In English; 14th; Advanced neutron sources
Report No.(s): DE98-057788; ANL/IPNS/CP-96852; CONF-980680; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The Spallation Neutron Source (SNS) is a 1 MW pulsed spallation source for neutron scattering planned for construction at Oak Ridge National Laboratory. This facility is being designed as a 5-laboratory collaboration project. This paper addresses the proposed facility layout, the process for selection and construction of neutron scattering instruments at the SNS, the initial planning done on the basis of a reference set of ten instruments, and the plans for research and development (R and D) to support construction of the first ten instruments and to establish the infrastructure to support later development and construction of additional instruments.
NTIS
Neutron Scattering; Spallation; Neutron Sources

19990026260 Department of Energy, Office of Energy Research, Washington, DC USA
Transverse momentum distributions of W and Z bosons produced in p (anti p) collisions at 1.8 TeV
Abbott, B., Department of Energy, USA; Oct. 31, 1997; 13p; In English; 18th; 18th; Lepton Photon Interactions, USA, USA
Report No.(s): DE98-051224; FNAL/C-97/355-E; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The transverse momentum distributions of W and Z bosons produced in p(anti p) collisions at (radical)s = 1.8 TeV are measured with the D0 detector at Fermilab. The results are compared to QCD calculations which include soft gluon resume. The transverse momentum distribution of the Z boson is consistent with the calculation of Ladinsky and Yuan.
NTIS
Gluons; Collisions; Bosons; Particle Collisions

19990026261 Department of Energy, Office of Energy Research, Washington, DC USA
Search for heavy neutral gauge bosons at D-Zero
Abbott, B., Department of Energy, USA; Oct. 31, 1997; 10p; In English; 18th; 18th; Lepton Photon Interactions, USA, USA
Report No.(s): DE98-051148; FNAL/C-97/367-E; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

We report preliminary results of a search for a heavy neutral gauge boson, Z', using the decay channel Z' (yields) ee . The data were collected with the D0 detector at the Fermilab Tevatron during the 1994-1995 p(anti p) collider run at (radical)s = 1.8 TeV and correspond to an integrated luminosity of (approx) 90 pb(sup -1). Limits are set on the cross section times branching ratio for the process (anti p)p (yields) Z' (yields) ee as a function of the Z' mass. We exclude the existence of a heavy neutral gauge boson of mass less than 660 GeV/c(sup 2) (95% CL), assuming a Z' with the same coupling strengths to quarks and leptons as the standard model Z boson. Combining this analysis with DO's 1992-1993 data set increases the limit to m(sub Z') > 670 GeV/c(sup 2) .
NTIS
Research; Bosons; Data Acquisition; Measuring Instruments

19990026265 Department of Energy, Washington, DC USA
Ion transport calculations using MCNP
Keen, N. D., Department of Energy, USA; Prinja, A. K., Department of Energy, USA; Little, R. C., Department of Energy, USA; Adams, K. J., Department of Energy, USA; Nov. 30, 1997; 10p; In English, USA; Sponsored by American Nuclear Society, USA
Report No.(s): DE97-009133; LA-UR-97-2519; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The MCNP Monte Carlo code (version 4B) has been adapted to perform multidimensional ion transport calculations in amorphous media for microelectronics materials applications. In this application, focused ion beams are used to implant donor ions through a mask into an underlying semiconductor substrate, achieving tailored implantation profiles as a function of penetration depth with a minimum of radial spread past the mask edge. However, as the device feature size shrinks below submicron scale, this radial migration of ions becomes important. Our goal is to simulate ion implantation in materials containing two and three dimensional heterogeneities for a variety of implant conditions (e.g., incident ion type, energy, incident angle, and problem geometry).
NTIS
Ions; Ion Implantation; Monte Carlo Method

19990026342 Department of Energy, Office of Energy Research, Washington, DC USA
Experimental studies of electroweak physics
Etzion, E., Department of Energy, USA; Sep. 30, 1997; 11p; In English; Fundamental Particles and Interactions, Unknown
Report No.(s): DE98-059143; SLAC-PUB-7654; CONF-9705220; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Some experimental new Electroweak physics results measured at the LEP/SLD and the TEVATRON are discussed. The excellent accuracy achieved by the experiments still yield no significant evidence for deviation from the Standard Model predictions, or signal to physics beyond the Standard Model. The Higgs particle still has not been discovered and a low bound is given to its mass.
NTIS
Electroweak Interactions (Field Theory); Elementary Particles; Standard Model (Particle Physics); Particle Theory

19990026343 Department of Energy, Office of Energy Research, Washington, DC USA
Leptoquarks at future lepton colliders
Rizzo, T. G., Department of Energy, USA; Oct. 31, 1997; 12p; In English; 2nd; Electron-Electron Interactions at TeV Energies, Unknown
Report No.(s): DE98-059155; SLAC-PUB-7675; CONF-9709173; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In this talk the author summarizes the capability of future lepton colliders to discover leptoquarks and to determine their electroweak quantum numbers. This analysis is an updated discussion based on the results presented in the Snowmass 1996 New Phenomena Working Group report as well as some more recent work that has appeared in the literature as a result of the HERA high-Q(sup 2) excess.
NTIS
Electroweak Interactions (Field Theory); Leptons; Quantum Numbers

19990026345 Department of Energy, Office of Energy Research, Washington, DC USA
Multiparticle dynamics 1997: Concluding talk
Bjorken, J. D., Department of Energy, USA; Nov. 30, 1997; 12p; In English; 27th; Multiple Dynamics, Unknown
Report No.(s): DE98-059170; SLAC-PUB-7708; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
This contribution to the XXVII Symposium on Multiparticle Dynamics held in Frascati, Italy, September, 1997 consists of the following subject matter: (1) introductory generalities; (2) brief mention of some of the contributions to the meeting; (3) more extended discussion of a few specialized topics; (4) discussion of the FELIX initiative for a QCD detector at the LHC.
NTIS
Quantum Chromodynamics; Radiation Detectors

19990026346 Department of Energy, Office of Energy Research, Washington, DC USA
Measurements of hadronic asymmetries in e(+)e(-) collisions at LEP and SLD
Etzion, E., Department of Energy, USA; Dec. 1, 1997; 8p; In English; High Energy Physics, Unknown
Report No.(s): DE98-059171; SLAC-PUB-7709; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
High precision experimental new electroweak results measured at the four LEP experiments and the SLD collaboration are discussed. Heavy quark (b(anti b) and c(anti c)) forward-backward asymmetries measured at LEP are presented along with polarized forward-backward and left-right asymmetries measured at SLD. The results are compared, and the combined averages are used to evaluate the Standard Model parameters.
NTIS
Electroweak Interactions (Field Theory); Elementary Particle Interactions; Quarks; Hadrons; Particle Collisions

19990026403 Japan Atomic Energy Research Inst., Tokyo, Japan
Radiochemical reactions between tritium and humid air
Sherman, R. H., Japan Atomic Energy Research Inst., Japan; Taylor, D. J., Japan Atomic Energy Research Inst., Japan; Honnell, K. G., Japan Atomic Energy Research Inst., Japan; Ohira, S., Japan Atomic Energy Research Inst., Japan; Kawamura, Y., Japan Atomic Energy Research Inst., Japan; Mar. 31, 1998; 7p; In English; 17th; Fusion Engineering, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA
Report No.(s): DE98-004356; LA-UR-97-4996; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Radiochemical reactions between pure tritium (T(sub 2)) and moist air have been examined using real-time Raman spectroscopy. The reacting constituents were contained in a 1 cu cm quartz cell sealed by a quartz-to-metal seal leading to a valve. A near-stoichiometric mixture of T2 and O2 was introduced into the cell, and the time evolution of the composition was monitored at 297 K for twenty-nine days. The production of T2O was observed in these experiments, for the first time unambiguously detected in Raman spectroscopy. T2O exhibits a relatively weak vibrational band at (approximately) 2,313 /cm. The radiochemical production of tritiated water did not occur in the expected 2:1 ratio, but rather with the O2 disappearing totally when the T2 was only slightly over halfway depleted. After the disappearance of O2, the T2 partial pressure continued to decrease, but at a slower rate. The initial water in the moist-air mixture disappeared totally after about 15 hours, with no concomitant production of HT. A small quantity of CO2 was also detected, presumably produced by radiochemically driven reactions with stainless steel components.
NTIS
Safety; Recovery; Chemical Effects; Chemical Reactions; Real Time Operation; Oxygen Tension; Carbon Dioxide

19990026421 Department of Energy, Washington, DC USA
Electron photon verification calculations using MCNP4B
Gierga, D. P., Department of Energy, USA; Adams, K. J., Department of Energy, USA; Dec. 31, 1998; 8p; In English; Radiation protection and shielding: technologies for the new century
Report No.(s): DE98-003490; LA-UR-98-363; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
MCNP4B was released in February 1997 with significant enhancements to electron/photon transport methods. These enhancements have been verified against a wide range of published electron/photon experiments, spanning high energy bremss-

trahlung production to electron transmission and reflection. Three sets of bremsstrahlung experiments were simulated. The first verification calculations for bremsstrahlung production used the experimental results in Faddegon for 15 MeV electrons incident on lead, aluminum, and beryllium targets. The calculated integrated bremsstrahlung yields, the bremsstrahlung energy spectra, and the mean energy of the bremsstrahlung beam were compared with experiment. The impact of several MCNP tally options and physics parameters was explored in detail. The second was the experiment of O'Dell which measured the bremsstrahlung spectra from 10 and 20.9 MeV electrons incident on a gold/tungsten target. The final set was a comparison of relative experimental spectra with calculated results for 9.66 MeV electrons incident on tungsten based on the experiment of Starfelt and Koch. The transmission experiments of Ebert were also studied, including comparisons of transmission coefficients for 10.2 MeV electrons incident on carbon, silver, and uranium foils. The agreement between experiment and simulation was usually within two standard deviations of the experimental and calculational errors.
NTIS
Electrons; Photons

19990026422 Department of Energy, Office of Energy Research, Washington, DC USA
Measuring the (anti u)/(anti d) asymmetry in the proton sea: Fermilab E866
Hawker, E. A., Department of Energy, USA; Awes, T., Department of Energy, USA; Brown, C., Department of Energy, USA; Dec. 31, 1998; 6p; In English; 33rd; Rencontres de moriond, QCD and high energy hadronic interactions
Report No.(s): DE98-003478; LA-UR-98-354; CONF-980357; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Experiment E866, conducted at the Fermi National Accelerator Laboratory, is a high statistics experiment to measure (anti u)(x)/(anti d)(x) in the proton over a wide range of x. A review of the current evidence for (anti u)(x) (ne) (anti d)(x) in the proton is given and is followed by a short description of the spectrometer and the experimental procedures used in E866. Preliminary results are shown for the ratio of the Drell-Yan cross sections sigma(sup pd) /2sigma(sup pp). The preliminary results confirm the conclusions of both the NMC and NA51 collaborations that there is an (anti u)/(anti d)(x) asymmetry in the proton sea.
NTIS
Protons; Asymmetry; Quarks

19990026464 Department of Energy, Office of Energy Research, Washington, DC USA
QCD studies at SLD: Identified hadron production in jets of different flavors
Kalelkar, M., Department of Energy, USA; Abe, K., Department of Energy, USA; Abe, K., Department of Energy, USA; Sep. 30, 1997; 14p; In English; High Energy Physics, Unknown, Unknown
Report No.(s): DE98-059132; SLAC-PUB-7639; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors have measured the differential cross sections for the production of pi(+/-), K(+/-), K(0), K(*)(892), phi(1020), p and Lambda in hadronic Z(0) decays and in subsets of flavor-tagged Z(0) yields light-flavor (u(anti u), d(anti d), or s(anti s)), Z(0) yields c(anti c) and Z(0) yields b(anti b) events. Charged hadrons were identified with the SLD Cherenkov Ring Imaging Detector. A vertex detector was employed to select flavor-enriched samples, and the polarized electron beam from SLC was used to tag quark and antiquark jets. The authors observes a flavor dependence in the hadron fragmentation functions. They also present evidence for leading particle production in hadronic decays of the Z(0) boson to light-flavor jets and a direct measurement of the strangeness suppression factor gamma(sub s).
NTIS
Hadrons; Quantum Chromodynamics; Particle Production; Electron Beams; Particle Decay; Flavor (Particle Physics)

19990026528 Department of Energy, Office of Energy Research, Washington, DC USA
Study of correlations between identified charged hadrons in hadronic Z(exp 0) decays
Abe, K., Department of Energy, USA; Abe, K., Department of Energy, USA; Abe, T., Department of Energy, USA; Jun. 30, 1998; 27p; In English; 29th; High-Energy Physics, Unknown
Report No.(s): DE98-059223; SLAC-PUB-7824; CONF-980748; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors present a preliminary study of correlations in rapidity between pairs of identified pions, kaons and protons in hadronic Z(0) decays into light flavors. Short range charge correlations are observed between all combinations of these hadron species, confirming that charge, strangeness and baryon number are conserved locally in the jet fragmentation process. The range of this effect is found to be independent of momentum. A strong long-range correlation is observed for high-momentum charged kaon pairs, and weaker long- range pi(+)-pi(-), pi(+)-K(-) and p-K(-) correlations are observed. The SLC electron beam polarization is used to tag the quark hemisphere in each event, allowing the first study of rapidities signed such that positive rapidity is

along the quark rather than antiquark direction. Distributions of signed rapidities and of ordered differences between signed rapidities provide new insights into leading particle production and several new tests of fragmentation models.
NTIS
Particle Decay; Hadrons; Particle Production; Quarks

19990026529 Department of Energy, Office of Energy Research, Washington, DC USA
Preliminary direct measurement of the parity-violating coupling of the Z(0) to strange quarks, A(s)
Abe, K., Department of Energy, USA; Abe, K., Department of Energy, USA; Abe, T., Department of Energy, USA; Jun. 30, 1998; 22p; In English; 29th; High-Energy Physics, Unknown
Report No.(s): DE98-059224; SLAC-PUB-7825; CONF-980748; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors present a preliminary direct measurement of the parity violating coupling of the Z(0) to strange quarks, A(s), derived from a sample of approximately 300,000 hadronic decays of Z(0) bosons produced with a polarized electron beam and recorded by the SLD experiment at SLAC between 1993 and 1997. Z(0) yields s(anti s) events are tagged by the presence in each event hemisphere of a high-momentum K(+/-), K(s)(0) or Lambda(0)/(anti Lambda)(0) identified using the Cherenkov Ring Imaging Detector and/or a mass tag. The CCD vertex detector is used to suppress the background from heavy flavor events. The strangeness of the tagged particle is used to sign the event thrust axis in the direction of the initial s quark. The coupling A(s) is obtained directly from a measurement of the left-right-forward-backward production asymmetry in polar angle of the tagged s quark. to reduce the model dependence of the measurement, the background from u(anti u) and d(anti d) events is measured from the data, as is the analyzing power o the method for s(anti s) events. The authors measure A(s) = 0.82 +/- 0.10(stat.) +/- 0.07(syst.).
NTIS
Quarks; Bosons; Hadrons; Particle Decay; Parity

19990026563 Rutherford Appleton Lab., Chilton, UK
The Phenomenology of W (+/-) H(-/+) Production at the Large Hadron Collider
Moretti, Stefano, Rutherford Appleton Lab., UK; Odagiri, Kosuke, Cambridge Univ., UK; Sep. 16, 1998; 17p; In English
Report No.(s): RAL-TR-1998-063; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11, 0X, UK), Hardcopy, Microfiche

Barrientos Bendezu and Kniehl recently suggested that W(+/-) H(-/+) associated production may be a useful channel in the search for the elusive heavy charged Higgs bosons of the 2 Higgs Doublet Model at the Large Hadron Collider. We investigate the phenomenology of this mechanism in the Minimal Supersymmetric Standard Model, with special attention paid to the most likely heavy Higgs decay, H(+/-) to tb to b(bar b)W(-/+), and to the irreducible background from top pair production. We find that the semi-leptonic signature "b(bar b)W(+)W(-) to b(bar b) jj l + missing momentum" is dominated by top-antitop events, which overwhelm the charged Higgs signal over the heavy mass range that can be probed at the CERN collider.
Author
Phenomenology; Pair Production; Higgs Bosons

19990026578 Rutherford Appleton Lab., Chilton, UK
Secondary Heavy Quark Pair Production in e(+)e(-) Annihilation
Miller, D. J., Rutherford Appleton Lab., UK; Seymour, Michael H., Rutherford Appleton Lab., UK; Jun. 10, 1998; ISSN 1358-6254; 10p; In English
Report No.(s): RAL-TR-1998-042; hep-ph/9805414; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11 0QX, UK), Hardcopy, Microfiche

The multiplicity of heavy quarks from gluon splitting in e(+)e(-) annihilation has now been theoretically calculated and experimentally measured at LEP. However, the experimental measurement requires theoretical input for the shape of the multiplicity with respect to an event shape. In this paper we calculate the multiplicity of heavy quarks from gluon splitting in e(+)e(-) annihilation as a function of the heavy jet mass of the event, to next-to-leading logarithmic accuracy. We compare our result with Monte Carlo predictions.
Author
Positron Annihilation; Electron-Positron Pairs; Quarks; Gluons; Splitting

19990026579 Rutherford Appleton Lab., Chilton, UK

The Jet Multiplicity as a Function of Thrust

Miller, D. J., Rutherford Appleton Lab., UK; Seymour, M. H., Rutherford Appleton Lab., UK; Jun. 10, 1998; ISSN 1358-6254; 18p; In English

Report No.(s): RAL-TR-1998-041; hep-ph/9805413; Copyright; Avail: Issuing Activity (CDRL, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11 0QX, UK), Hardcopy, Microfiche

We calculate the average multiplicity of jets in e(+)e(-) annihilation as a function of both the jet resolution parameter, y(sub cut), and the thrust T. Our result resums to all orders the leading and next-to-leading logarithms in y(sub cut) and 1 - T, and is exact up to the second order in alpha(sub s). This allows a comparison between the number of jets found using jet algorithms and the ability to distinguish different jet topologies via thrust.

Author

Jet Thrust; Positron Annihilation; Electron-Positron Pairs

19990026580 National Inst. for Fusion Science, Toki, Japan

Pair Creations of Negative and Positive Pionlike (Muonlike) Particle or K Mesonlike (Muonlike) Particle in H2 or D2 Gas Discharge in Magnetic Field

Uramoto, Joshin, National Inst. for Fusion Science, Japan; Dec. 1997; ISSN 0915-633X; 32p; In English

Report No.(s): NIFS-532; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Both negative pionlike (pi(-)) or muonlike (mu(-)) particles and positive pionlike (pi(+)) or muonlike (mu(+)) particles are extracted at an acceleration voltage of 800 V with H(-) ions and H(+), H3(+) ions from outside region of H2 gas discharge along magnetic field. Similarly, both negative K mesonlike (K(-)) or muonlike (mu(-)) particles and positive K mesonlike (K(+)) or muonlike (mu(+)) particles are extracted with D(-) ions and D(+), (D3(+)) ions from outside region of D2 gas discharge along magnetic field. Then, the pi(-), mu(-), K(-) particles are detected easily as the apparent current to the beam collector (BC) of a magnetic mass analyzer increases extremely when a positive bias voltage is applied to BC and positive ions are supplied in front of BC. It should be noted that the pi(+), mu(+), K(+) particles do not penetrate a metal plate while the pi(-), mu(-), K(-) particles penetrate the metal plate easily.

Author

Pair Production; Magnetic Fields; Gas Discharges; Muons; Pions

19990026594 Department of Energy, Office of Civilian Radioactive Waste Management, Washington, DC USA

Deterministic method for transient, three-dimensional neutron transport

Goluoglu, S., Department of Energy, USA; Bentley, C., Department of Energy, USA; DeMeglio, R., Department of Energy, USA; Dunn, M., Department of Energy, USA; Norton, K., Department of Energy, USA; Dec. 31, 1998; 8p; In English; Radiation Protection and Shielding: Technologies for the New Century, USA

Report No.(s): DE98-004994; CONF-980403-1; TPM-705; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A deterministic method for solving the time-dependent, three-dimensional Boltzmann transport equation with explicit representation of delayed neutrons has been developed and evaluated. The methodology used in this study for the time variable of the neutron flux is known as the improved quasi-static (IQS) method. The position, energy, and angle-dependent neutron flux is computed deterministically by using the three-dimensional discrete ordinates code TORT. This paper briefly describes the methodology and selected results. The code developed at the University of Tennessee based on this methodology is called TDTORT. TDTORT can be used to model transients involving voided and/or strongly absorbing regions that require transport theory for accuracy. This code can also be used to model either small high-leakage systems, such as space reactors, or asymmetric control rod movements. TDTORT can model step, ramp, step followed by another step, and step followed by ramp type perturbations. It can also model column-wise rod movement. A special case of columnwise rod movement in a three-dimensional model of a boiling water reactor (BWR) with simple adiabatic feedback is also included. TDTORT is verified through several transient one-dimensional, two-dimensional, and three-dimensional benchmark problems. The results show that the transport methodology and corresponding code developed in this work have sufficient accuracy and speed for computing the dynamic behavior of complex multi-dimensional neutronic systems.

NTIS

Three Dimensional Models; Mathematical Models; Transport Theory; Time Dependence; Neutrons; Boltzmann Transport Equation

19990026655 Department of Energy, Office of Energy Research, Washington, DC USA

Improving the staggered quark action to reduce flavor symmetry violations

Lagaee, J. F., Department of Energy, USA; Sinclair, D. K., Department of Energy, USA; Dec. 31, 1998; 3p; In English; 15th; Lattice Field Theory (Lattice-15), USA

Report No.(s): DE98-057813; ANL/HEP/CP-98-13; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors investigate a class of actions for lattice Quantum Chromodynamics (QCD) with staggered quarks aimed at reducing the flavor symmetry violations associated with using staggered fermions. These actions replace the gauge field link fields in the quark action with covariantly smeared fields. As such they are an extension of actions considered by the MILC collaboration. They show that such actions systematically reduce flavor symmetry violations in the weak coupling limit. Using the mass splitting between Goldstone and non-Goldstone pions as a measure of flavor symmetry violations they find that these actions have considerably less flavor symmetry violations than the standard staggered action, and represent an improvement on what can be achieved with the MILC action, on quenched configurations with (beta) = 5.7.

NTIS

Quarks; Broken Symmetry

19990026663 Department of Energy, Office of Energy Research, Washington, DC USA

Measurement of the ratio of production cross sections for W + 1 jet to W + 0 jets and comparisons to QCD

Abbott, B., Department of Energy, USA; Nov. 30, 1997; 12p; In English; 18th; 18th; Lepton Photon Interactions, USA, USA

Report No.(s): DE98-051150; FNAL/C-97/369-E; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A preliminary measurement of the ratio, R(sup 10), of the production cross sections for W + 1 Jet and W + 0 Jets processes at (radical)s = 1800 GeV by the D0 Collaboration is presented. A comparison of this ratio is made to next-to-leading order calculations and the implications of these comparisons are discussed.

NTIS

Radicals; Electromagnetic Measurement; Jet Flow; Scattering Cross Sections

19990026669 Department of Energy, Office of Energy Research, Washington, DC USA

D-Zero results on W boson properties

Abbott, B., Department of Energy, USA; Oct. 31, 1997; 20p; In English

Report No.(s): DE98-051105; FNAL/C-97/354-E; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The D0 experiment collected (approx) 15/ pb in run 1A (1992- 1993) and (approx) 89/ pb in run 1B (1994-1995) of the Fermilab Tevatron Collider using p(anti p) collisions at (radical)s = 1.8 TeV. Results from analyses of events with W and Z bosons are presented for the run 1B data samples. From W (yields) e(nu), (mu)(nu) and Z (yields) ee, (mu)(mu) decays, the W and Z production cross sections and the W width are determined. Events with W (yields) (tau)(nu) decays are used to determine the ratio of the electroweak gauge coupling constants as a measure of lepton universality. Using W (yields) e(nu) and Z (yields) ee decays, the W boson mass is measured.

NTIS

Bosons; Collisions; Electroweak Interactions (Field Theory); Leptons

19990026679 Department of Energy, Office of Energy Research, Washington, DC USA

Crystal ball single event display

Grosnick, D., Department of Energy, USA; Gibson, A., Department of Energy, USA; Allgower, C., Department of Energy, USA; Alyea, J., Department of Energy, USA; Oct. 15, 1997; 24p; In English

Report No.(s): DE98-004783; ANL-HEP-TR-97-86; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Single Event Display (SED) is a routine that is designed to provide information graphically about a triggered event within the Crystal Ball. The SED is written entirely in FORTRAN and uses the CERN-based HICZ graphing package. The primary display shows the amount of energy deposited in each of the NaI crystals on a Mercator-like projection of the crystals. Ten different shades and colors correspond to varying amounts of energy deposited within a crystal. Information about energy clusters is displayed on the crystal map by outlining in red the thirteen (or twelve) crystals contained within a cluster and assigning each cluster a number. Additional information about energy clusters is provided in a series of boxes containing useful data about the energy distribution among the crystals within the cluster. Other information shown on the event display include the event trigger type

and data about (pi) (sup o)'s and (eta)'s formed from pairs of clusters as found by the analyzer. A description of the major features is given, along with some information on how to install the SED into the analyzer.
NTIS
Sodium Iodides; Computer Graphics; Crystals; Mercator Projection; Indicating Instruments

19990026717 California Inst. of Tech., Arthur AMOS Noyes Lab. of Chemical Physics, Pasadena, CA USA
Resonance Enhanced Multiphoton Ionization Spectra of Molecules and Molecular Fragments and Femtosecond Energy- and Angle-Resolved Pump-Probe Photoelectron Spectra ***Final Report***
McKoy, Vincent; Oct. 31, 1998; 46p; In English
Contract(s)/Grant(s): F49620-95-1-0012; AF Proj. 2303
Report No.(s): AD-A359973; AFRL-SR-BL-TR-99-0038; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We have completed studies of ion rotational distributions produced by resonance multiphoton ionization of molecules, molecular fragments and small clusters such as NaH2O and NaNH3. Our key objective was to provide a robust analysis and prediction of spectral features of interest in related experimental studies and technological applications of laser driven ionization. We have also extended our studies of photoelectron spectroscopy from the energy domain to the ultrafast time domain with an emphasis on exploiting femtosecond energy- and angle-resolved photoelectron spectra for real-time mapping of wavepacket motion in molecular systems. We have developed a formulation of time-resolved photoelectron spectroscopy that is well suited for such applications. Results of applications provide compelling evidence of the unprecedented insight that such spectra can provide into both wavepacket motion and the evolution of the associated electronic structure. This capability shows significant promise as a probe of wavepacket motion in regions of avoided crossings (nonadiabatic behavior).
DTIC
Multiphoton Absorption; Photoelectron Spectroscopy; Molecular Clusters

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NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory. For space radiation see 93 Space Radiation.

19990025903 Department of Energy, Washington, DC USA
Neutron activation analysis at the Californium User Facility for Neutron Science
Martin, R. C., Department of Energy, USA; Smith, E. H., Department of Energy, USA; Glasgow, D. C., Department of Energy, USA; Jerde, E. A., Department of Energy, USA; Marsh, D. L., Department of Energy, USA; Dec. 31, 1997; 11p; In English; Radiation protection and shielding: technologies for the new century
Report No.(s): DE98-001904; ORNL/CP-95775; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Californium User Facility (CUF) for Neutron Science has been established to provide Cf-252-based neutron irradiation services and research capabilities including neutron activation analysis (NAA). A major advantage of the CUF is its accessibility and controlled experimental conditions compared with those of a reactor environment The CUF maintains the world's largest inventory of compact Cf-252 neutron sources. Neutron source intensities of (le)10(exp 11) neutrons/s are available for irradiations within a contamination-free hot cell, capable of providing thermal and fast neutron fluxes exceeding 10(exp 8) cm(-2) s(-1) at the sample. Total flux of (ge)10(exp 9) cm(-2) s(-1) is feasible for large-volume irradiation rabbits within the Cf-252 storage pool. Neutron and gamma transport calculations have been performed using the Monte Carlo transport code MCNP to estimate irradiation fluxes available for sample activation within the hot cell and storage pool and to design and optimize a prompt gamma NAA (PGNAA) configuration for large sample volumes. Confirmatory NAA irradiations have been performed within the pool. Gamma spectroscopy capabilities including PGNAA are being established within the CUF for sample analysis.
NTIS
Neutron Activation Analysis; Neutron Sources

19990025996 Department of Energy, Office of Energy Research, Washington, DC USA
Search for SUSY at LHC: Precision Measurements
Paige, F. E., Department of Energy, USA; Dec. 31, 1997; 9p; In English; High Energy Physics
Report No.(s): DE98-002638; BNL-65029; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Methods to make precision measurements of SUSY masses and parameters at the CERN Large Hadron Collider are described.
NTIS
Precision; Hadrons; Supersymmetry

19990026009 Department of Energy, Office of Energy Research, Washington, DC USA
Search for narrow states in the inclusive gamma ray spectra resulting from antiproton annihilations at rest in liquid hydrogen and deuterium
Graf, N. A., Department of Energy, USA; Fero, M., Department of Energy, USA; Gee, M., Department of Energy, USA; Aug. 31, 1991; 58p; In English
Report No.(s): DE98-006384; DOE/ER/71019-T3-PT.2; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The energy spectrum of gamma rays produced in proton-antiproton annihilation at rest in hydrogen and deuterium has been measured with good energy resolution and high statistics. The data were taken using the PS183 magnetic pair spectrometer at LEAR (CERN). A detailed search of the gamma spectrum yielded no evidence of gamma transitions to narrow states with widths consistent with the spectrometer resolution. In hydrogen, upper limits (95% CL) are obtained for the yield of narrow states of 2--5 x 10(sup -4) for states below 1,700 MeV/c(sup 2), and 5--10 x 10(sup -4) for states between 1,700 and 1,800 MeV/c(sup 2). In deuterium, the corresponding upper limits are, 1--7 x 10(sup -3) for masses between 700 and 1, 730 MeV/c(sup 2), and 1--2 x 10(sup -3) for masses between 1,750 and 1,835 MeV/c(sup 2). These results contradict reports of the observation of narrow lines made by previous experiments.
NTIS
Research; Gamma Ray Spectra; Antiprotons; Annihilation Reactions; Liquid Hydrogen; Deuterium

19990026154 Department of Energy, Office of Energy Research, Washington, DC USA
Synchrotron based spallation neutron source concepts
Cho, Y., Department of Energy, USA; Dec. 31, 1998; 5p; In English; 1st; Asian Particle Accelerator
Report No.(s): DE98-057798; ANL/APS/CP-95977; CONF-980359; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

During the past 20 years, rapid-cycling synchrotrons (RCS) have been used very productively to generate short-pulse thermal neutron beams for neutron scattering research by materials science communities in Japan (KENS), the UK (ISIS) and the US (IPNS). The most powerful source in existence, ISIS in the UK, delivers a 160 kW proton beam to a neutron-generating target. Several recently proposed facilities require proton beams in the MW range to produce intense short-pulse neutron beams. In some proposals, a linear accelerator provides the beam power and an accumulator ring compresses the pulse length to the required approximately 1 (micro)s. In others, RCS technology provides the bulk of the beam power and compresses the pulse length. Some synchrotron-based proposals achieve the desired beam power by combining two or more synchrotrons of the same energy, and others propose a combination of lower and higher energy synchrotrons. This paper presents the rationale for using RCS technology, and a discussion of the advantages and disadvantages of synchrotron-based spallation sources.
NTIS
Synchrotrons; Spallation; Neutron Sources

19990026205 Department of Energy, Office of Energy Research, Washington, DC USA
Measurement of charged hadron spectra at the Z(0) with Cherenkov ring imaging
Pavel, T., Department of Energy, USA; Aug. 31, 1997; 269p; In English
Report No.(s): DE98-059282; SLAC-R-491; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This dissertation attempts to probe hadronization, the process by which the fundamental quarks described by quantum chromodynamics produce the jets of hadrons that the author observed in experiments. The measurements are made using e(+)e(-) collisions at the SLAC Linear Collider (SLC), operating at the Z(0) resonance with the SLC Large Detector (SLD), and the unique capabilities of the SLC/SLD facility are exploited. First, the spectra of charged hadrons (pi(+/-)), K(+/-), and p/(anti p) are measured. This is accomplished with the SLD Cherenkov Ring Imaging Detector (CRID), one of a first generation of devices that have been developed for efficient particle identification over a wide momentum range. The use of the CRID is central to this dissertation, and its design and performance are described in detail here. The measured spectra agree with other measurements at the Z(0) and extend the momentum coverage. Next, the excellent spatial resolution of the SLD tracking systems, along with the small and stable beam spots of the SLC, is employed to identify jets produced from heavy b or c quarks and to separate them from the remaining light-quark (uds) jets. This removes the effects of heavy quark fragmentation and decays of heavy-quark hadrons from the

study of hadronization. The first measurements of particle spectra in light-quark jets are then presented. Finally, the highly-polarized incident electron beam of the SLC, together with the electroweak asymmetries of the quarks, is exploited to separate quark and antiquark jets. Significant differences in quark-antiquark production of protons and of kaons are observed at high momenta. This signal suggests a leading particle effect, where the particles containing the primary quark of a jet are more likely to populate the high-momentum phase space than are other hadrons.
NTIS
Electroweak Interactions (Field Theory); Bosons; Quantum Chromodynamics; Particle Decay; Particle Collisions; Cerenkov Counters; Particle Production

19990026209 Department of Energy, Office of Energy Research, Washington, DC USA
High energy photon-photon and electron-photon collisions
Brodsky, S. J., Department of Energy, USA; Jan. 31, 1998; 12p; In English; 2nd; Electron-Electron Interactions at TeV Energies, Unknown
Report No.(s): DE98-059184; SLAC-PUB-7732; CONF-9709173; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The advent of a next linear e(+/-)e(-) collider and back- scattered laser beams will allow the study of a vast array of high energy processes of the Standard Model through the fusion of real and virtual photons and other gauge bosons. As examples, The author discusses virtual photon scattering gamma(*)-gamma(*) yields X in the region dominated by BFKL hard Pomeron exchange and report the predicted cross sections at present and future e(+/-)e(-) colliders. The authors also discusses exclusive gamma-gamma reactions in QCD as a measure of hadron distribution amplitudes and a new method for measuring the anomalous magnetic and quadrupole moments of the W and Z gauge bosons to high precision in polarized electron-photon collisions.
NTIS
Elementary Particle Interactions; Standard Model (Particle Physics); Photons; Quantum Chromodynamics; Laser Beams; Electrons; Bosons

19990026283 Department of Energy, Office of Energy Research, Washington, DC USA
MSSM and Higgs Searches at the Tevatron
Valls, J. A., Department of Energy, USA; Sep. 30, 1998; 9p; In English; 29th; High-Energy Physics, 1998, Unknown
Report No.(s): DE98-059313; FNAL/C-98/292-E; CONF-980748; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In this paper a summary of present CDF and D0 results on supersymmetry and Higgs searches at Tevatron is presented. Analysis include results from a variety of signatures: missing E(sub T) and jets (or leptons and jets) for squark/gluino searches, trileptons and missing E(sub T) for gaugino searches and, for the first time, charmed-tagged jets and missing E(sub T) as a new signature for stop quark pair production. We show also results for various searches of standard and non-standard model Higgs bosons in hadron collisions. The seeked signature is Higgs associated production with a vector boson. Different channels involve jets and leptons from vector boson decays and b-tagged jets or photons from Higgs decays.
NTIS
Higgs Bosons; Pair Production; Particle Decay; Detectors; Supersymmetry

19990026284 Department of Energy, Office of Energy Research, Washington, DC USA
Study of high field quantum electrodynamics in the collision of high energy electrons with a terawatt laser
Horton-Smith, G. A., Department of Energy, USA; Jul. 31, 1998; 205p; In English
Report No.(s): DE98-059296; SLAC-R-529; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

An experiment is described which studied quantum electrodynamic interactions under conditions of extremely high fields, along with a review of the relevant theory. The high fields were created by an intense, tightly-focused pulse of laser light at green or infrared wavelengths, into which was sent an ultra-relativistic electron beam of 46.6-GeV energy. The relevant theory is that of an electron in an electromagnetic wave so intense that the electron's mass is effectively shifted by the transverse momentum imparted to it by the wave, and the electron encounters field strengths comparable to the Schwinger critical field strength of 511 kV per Compton wavelength. An electron in the intense wave may radiate a photon and balance 4-momentum by absorbing multiple photons from the laser, which can lead to real photons with energies above the kinematic limit for conventional Compton scattering. All particles have significant probability of scattering multiple times while in the focus of the laser, including the photons radiated by the electrons, which may convert into electron-positron pairs, again with absorption of multiple photons from the laser. This experiment was able to measure the rates and spectra of positrons, electrons, and photons emerging from the interaction region. Results from both experiment and theoretical simulations are presented and compared. The results from the electron and

positron measurements are compatible with the accepted theory, within experimental uncertainties due mainly to the laser intensity measurement. The photon spectrum shows the correct shape, but the ratio of rates in the linear and two-absorbed-photon portions of the spectrum does not vary as expected with the laser intensity, suggesting a disagreement with the accepted theory, with a significance of roughly two standard deviations.
NTIS
Quantum Electrodynamics; Relativistic Electron Beams; Elementary Particle Interactions; Laser Beams

19990026340 Department of Energy, Office of Energy Research, Washington, DC USA
LEGO: A modular accelerator design code
Cai, Y., Department of Energy, USA; Donald, M., Department of Energy, USA; Irwin, J., Department of Energy, USA; Yan, Y., Department of Energy, USA; Aug. 31, 1997; 4p; In English; 17th; Particle Accelerator, Unknown; Sponsored by Institute of Electrical and Electronics Engineers, USA
Report No.(s): DE98-059134; SLAC-PUB-7642; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

An object-oriented accelerator design code has been designed and implemented in a simple and modular fashion. It contains all major features of its predecessors: TRACY and DESPOT. All physics of single-particle dynamics is implemented based on the Hamiltonian in the local frame of the component. Components can be moved arbitrarily in the three dimensional space. Several symplectic integrators are used to approximate the integration of the Hamiltonian. A differential algebra class is introduced to extract a Taylor map up to arbitrary order. Analysis of optics is done in the same way both for the linear and nonlinear case. Currently, the code is used to design and simulate the lattices of the PEP-II. It will also be used for the commissioning.
NTIS
Particle Accelerators; Computer Programs; Computer Aided Design; Object-Oriented Programming

19990026373 Department of Energy, Office of Energy Research, Washington, DC USA
Neutron scattering instruments of the Spallation Neutron Source
Crawford, R. K., Department of Energy, USA; Herwig, K. W., Department of Energy, USA; Dec. 31, 1998; 7p; In English; Nuclear Applications of Accelerator Technology, USA
Report No.(s): DE98-057828; ANL/IPNS/CP-96861; CONF-980921; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Spallation Neutron Source (SNS) is an accelerator-based short-pulse neutron scattering facility designed to meet the needs of the neutron scattering community in the US well into the next century. SNS is a US Department of Energy (DOE) construction project that is planned to be completed at Oak Ridge National Laboratory late in 2005. SNS is being designed and will be constructed by a 5-laboratory collaboration including Argonne National Laboratory, Brookhaven National Laboratory, Lawrence Berkeley National Laboratory, Los Alamos National Laboratory and Oak Ridge National Laboratory. The functional requirements for the SNS have been set by the scientific community and DOE. SNS will initially operate at 1 MW with one target station operating at 60 Hz and having 18 beam ports for neutron scattering experiments. The first 10 neutron scattering instruments are provided as part of the SNS construction project, and will be selected to span the types of science anticipated to be most important for this facility on the basis of input from the user community. This paper describes the process of selection and design of these first 10 instruments. The extensive R and D program to support the design and construction of these instruments and to help pave the way for future instruments will also be discussed. A set of 10 reference instruments has been developed to help establish the layout of the experiment hall and the interface between the instruments and the target station. This layout and some of the associated interface issues will be described. Examples of the design and performance of some of these reference instruments will also be discussed as an indication of the types of instrumentation involved and the new scientific capabilities that should be available when the SNS becomes operational.
NTIS
Neutron Scattering; Spallation; Neutron Sources; Functional Design Specifications

19990026400 Department of Energy, Office of Energy Research, Washington, DC USA
Cold source moderator vessel development for the High Flux Isotope Reactor: Thermal-hydraulic studies
Williams, P. T., Department of Energy, USA; Lucas, A. T., Department of Energy, USA; Wendel, M. W., Department of Energy, USA; Dec. 31, 1998; 8p; In English; Nuclear applications of accelerator technology, USA
Report No.(s): DE98-006062; ORNL/CP-98768; CONF-980921; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A project is underway at Oak Ridge National Laboratory (ORNL) to design, test, and install a cold neutron source facility in the High Flux Isotope Reactor (HFIR). This new cold source employs supercritical hydrogen at cryogenic temperatures both

as the medium for neutron moderation and as the working fluid for removal of internally-generated nuclear heating. The competing design goals of minimizing moderator vessel mass and providing adequate structural integrity for the vessel motivated the requirement of detailed multidimensional thermal-hydraulic analyses of the moderator vessel as a critical design subtask. This paper provides a summary review of the HFIR cold source moderator vessel design and a description of the thermal-hydraulic studies that were carried out to support the vessel development.
NTIS
Cold Neutrons; Neutron Sources; Design Analysis; Performance Tests; Fabrication; Installing; Structural Failure; High Flux Isotope Reactors

19990026401 Department of Energy, Office of Energy Research, Washington, DC USA
Radiation induced cavitation: A possible phenomenon in liquid targets
West, C. D., Department of Energy, USA; Dec. 31, 1998; 6p; In English; Nuclear applications of accelerator technology, USA
Report No.(s): DE98-006061; ORNL/CP-98775; CONF-980921; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The proposed design of a new, short-pulse spallation neutron source includes a liquid mercury target irradiated with a 1 GeV proton beam. This paper explores the possibility that cavitation bubbles may be formed in the mercury and briefly discusses some design features that could avoid harmful effects should cavitation take place.
NTIS
Targets; Design Analysis; Neutron Sources; Cavitation Flow; Mercury (Metal)

19990026406 Department of Energy, Office of Financial Management and Controller, Washington, DC USA
New developments and applications of intense pulsed radiation sources at Sandia National Laboratories
Cook, D., Department of Energy, USA; Feb. 28, 1998; 14p; In English; 11th; Pulsed Power, USA
Report No.(s): DE98-004138; SAND-98-0544C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In the past thirty-six months, tremendous strides have been made in x-ray production using high-current z-pinches. Today, the x-ray energy (1.9 MJ) and power (200 TW) output of the Z accelerator (formerly PBFA-II) is the largest available in the laboratory. These z-pinch x-ray sources are being developed for research into the physics of high energy density plasmas of interest in weapon behavior and in inertial confinement fusion. Beyond the Z accelerator current of 20 MA, an extrapolation to the X-1 accelerator level of 60 MA may have the potential to drive high-yield ICF reactions at affordable cost if several challenging technical problems can be overcome. New developments have also taken place at Sandia in the area of high current, mm-diameter electron beams for advanced hydrodynamic radiography. On SABRE, x-ray spot diameters were less than 2 mm with a dose of 100 R at 1 meter in a 40 ns pulse.
NTIS
Pulsed Radiation; Radiation Sources; X Ray Sources; Linear Accelerators; Zeta Pinch

19990026414 Department of Energy, Washington, DC USA
Development of the activation analysis calculational methodology for the Spallation Neutron Source (SNS)
Odano, N., Department of Energy, USA; Johnson, J. O., Department of Energy, USA; Charton, L. A., Department of Energy, USA; Barnes, J. M., Department of Energy, USA; Mar. 31, 1998; 11p; In English; Radiation protection and shielding: technologies for the new century
Report No.(s): DE98-004119; ORNL/CP-96528; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

For the design of the proposed Spallation Neutron Source (SNS), activation analyses are required to determine the radioactive waste streams, on-line material processing requirements remote handling/maintenance requirements, potential site contamination and background radiation levels. For the conceptual design of the SNS, the activation analyses were carried out using the high-energy transport code HETC96 coupled with MCNP to generate the required nuclide production rates for the ORIHET95 isotope generation code. ORIHET95 utilizes a matrix-exponential method to study the buildup and decay of activities for any system for which the nuclide production rates are known. In this paper, details of the developed methodology adopted for the activation analyses in the conceptual design of the SNS are presented along with some typical results of the analyses.
NTIS
Activation Analysis; Spallation; Neutron Sources; Computation

19990026417 Department of Energy, Office of Energy Research, Washington, DC USA

Design of a cold neutron irradiator (CNI) for quantitative materials characterization

Atwood, A. G., Department of Energy, USA; Aug. 31, 1997; 182p; In English

Report No.(s): DE98-003524; DOE/ER/75780-2-PT.2; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A design study of a cold neutron irradiator (CNI) for materials characterization using prompt gamma-ray neutron activation analysis (PGNAA) is presented. Using Cf-252 neutron sources in a block of moderator, a portion of which is maintained at a cryogenic temperature, the CNI employs cold neutrons instead of thermal neutrons to enhance the neutron capture reaction rate in a sample. Capture gamma rays are detected in an HPGe photon detector. Optimization of the CNI with respect to elemental sensitivity (counts per mg) is the primary goal of this design study. Monte Carlo simulation of radiation transport, by means of the MCNP code and the ENDF/B cross-section libraries, is used to model the CNI. A combination of solid methane at 22 K, room temperature polyethylene, and room-temperature beryllium has been chosen for the neutron delivery subsystem of the CNI. Using four 250 microgram Cf-252 neutron sources, with a total neutron emission rate of 2.3 x 10(exp 9) neutrons/s, a thermal-equivalent neutron flux of 1.7 x 10(exp 7) neutrons/sq cm - s in an internally located cylindrical sample space of diameter 6.5 cm and height 6.0 cm is predicted by MCNP calculations. A cylindrical port with an integral annular collimator composed of bismuth, lead, polyethylene, and lithium carbonate, is located between the sample and the detector. Calculations have been performed of gamma-ray and neutron transport in the port and integral collimator with the objective of optimizing the statistical precision with which one can measure elemental masses in the sample while also limiting the fast neutron flux incident upon the HPGe detector to a reasonable level. The statistical precision with which one can measure elemental masses can be enhanced by a factor of between 2.3 and 5.3 (depending on the origin of the background gamma rays) compared with a neutron irradiator identical to the CNI except for the replacement of the cryogenic solid methane by room-temperature polyethylene. The projected performance of the CNI in the measurement of elemental concentrations is presented. In an illustrative calculation, it is projected that 5 ppm of boron in a silicon dioxide sample can be measured by PGNAA to within a statistical precision of +/-20% in 30 minutes.

NTIS

Cold Neutrons; Neutron Sources; Design Analysis

19990026423 Department of Energy, Office of Energy Research, Washington, DC USA

LAHET code system benchmarking in the accelerator production of tritium November 1995 small scale tritium production experiment

Court, J. D., Department of Energy, USA; Pitcher, E. J., Department of Energy, USA; Russell, G. J., Department of Energy, USA; Ferguson, P. D., Department of Energy, USA; Patton, B. W., Department of Energy, USA; Dec. 31, 1998; 10p; In English; Sponsored by American Nuclear Society, USA

Report No.(s): DE98-003475; LA-UR-98-256; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

An experiment conducted at the Los Alamos Neutron Science Center in November 1995 was used to benchmark tritium production calculations using the LAHET Code System (LCS). 800 MeV protons incident on tungsten targets, with a lead moderator/reflector, were used to create a neutron flux incident on aluminum spheres and capsules containing He-3 for the production of tritium from the He-3 He(n,p) H-3 reaction. Tritium production was calculated in four aluminum spheres inserted into the central cavity of the target assembly, as well as several cylindrical capsules placed at different positions in the target assembly. Bare and cadmium covered gold foils were placed in the assembly, and calculations of Au-198 production were compared to experimental measurements. Finally, nylon films were inserted in the beam path to record the beam profile through the exposure of the film. These beam profile measurements are also compared to LCS calculations.

NTIS

Accelerators; Tritium

19990026524 Department of Energy, Office of Energy Research, Washington, DC USA

Electroweak and heavy flavor physics at SLD

Willocq, S., Department of Energy, USA; Dec. 31, 1997; 11p; In English; Front End of the Muon Colliders, Unknown

Report No.(s): DE98-059177; SLAC-PUB-7719; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors review recent electroweak and B physics results obtained in polarized e(+)e(-) interactions at the SLC by the SLD experiment. Unique and precise measurements of the electroweak parameters A(sub e), A(sub b), A(sub c), R(sub b) and R(sub c) provide powerful constraints on the Standard Model. The excellent 3-D vertexing capabilities of SLD are further exploited to extract precise B(+) and B(d)(0) lifetimes, as well as measurements of the time evolution of B(0)-(B-bar(0)) mixing.

NTIS

Electroweak Interactions (Field Theory); Electron-Positron Pairs; Elementary Particle Interactions; Elementary Particles

19990026526 Department of Energy, Office of Energy Research, Washington, DC USA

Preliminary study of the structure of b(anti b)g events using Z(0) decays

Abe, K., Department of Energy, USA; Abe, K., Department of Energy, USA; Abe, T., Department of Energy, USA; Jun. 30, 1998; 25p; In English; 29th; High-Energy Physics, Unknown

Report No.(s): DE98-059221; SLAC-PUB-7822; CONF-980748; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The structure of three-jet b(anti b)g events has been studied using hadronic Z(0) decays recorded in the SLD experiment at SLAC. Three-jet final states were selected and the CCD-based vertex detector was used to identify two of the jets as a b or (anti b). The distributions of the gluon energy and polar angle with respect to the electron beam were examined and were compared with perturbative QCD predictions. These distributions are potentially sensitive to an anomalous b chromomagnetic moment kappa. The authors measure kappa consistent with zero and set limits on its value.

NTIS

Quantum Chromodynamics; Particle Decay; Hadrons; Quarks; Gluons; Bosons

19990026527 Department of Energy, Office of Energy Research, Washington, DC USA

Symmetry tests in polarized Z(0) decays to b(anti b)g

Abe, K., Department of Energy, USA; Abe, K., Department of Energy, USA; Abe, T., Department of Energy, USA; Jun. 30, 1998; 24p; In English; 29th; High-Energy Physics, Unknown

Report No.(s): DE98-059222; SLAC-PUB-7823; CONF-980748; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Angular asymmetries have been measured in polarized Z(0) decays to b(anti b)g collected by the SLD experiment at the SLC. A high purity b(anti b)g event sample is selected utilizing lifetime information given by the SLD CCD pixel vertex detector and the stable micron-size SLC beams, and the b- and (anti b)-jets are identified using lifetime information and momentum-weighted track charge. Parity violating asymmetries in the b-quark polar and azimuthal angles are measured to test the Standard model. Two angular correlations between the three-jet plane and the Z(0) polarization are used to perform symmetry tests. The CP-even and T-odd, and the CP-odd and T-odd, angular asymmetries are sensitive to physics beyond the Standard Model. The authors measure the expectation values of these quantities to be consistent with zero and set limits on the correlations at the 5% level.

NTIS

Particle Decay; Hadrons; Bosons; Quarks; Asymmetry

19990026597 Department of Energy, Office of Energy Research, Washington, DC USA

High energy physics studies: Task D

Molzon, W. R., Department of Energy, USA; Aug. 31, 1991; 43p; In English

Report No.(s): DE98-006389; DOE/ER/71019-T5-PT.1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The major research activity of Task D has been collaboration in experiments E791 and E871 at Brookhaven National Laboratory. During the past year, the collaboration has published results of the second major run, nearly completed analysis of the final data from the experiment and reported some of these results in conferences. The authors now have a substantially better understanding of the potential backgrounds and systematic uncertainties in the experiment. This understanding is important for both the results to be derived from the present data and for future experiments. In addition, they have conducted extensive tests for the new experiment at Brookhaven. Their goal is to improve the sensitivity to rare decay modes of kaons by a factor of 20 over the final E791 result. In the coming year the authors will finish the final analysis of all data from the experiment, including a consistent reanalysis of all data and preparation of a Phys. Rev. D article describing the measurement. Assuming approval of E871 by BNL, they will finalize detailed design of the experiment and begin prototype testing and construction. In addition to the ongoing efforts on E791 and E871 at BNL, they have begun looking at the possibility of mounting a substantially improved experiment to be performed at the proposed Main Injector at Fermilab. This effort would be part of a Main Injector Kaon Facility. In this contract renewal request, they will review the current status of lepton flavor violation in K decays, summarize the status of the experiment, report in some detail on a number of the specific projects in which personnel supported by this contract have been involved, discuss the possibilities for future directions of the experiment, and list specific requests to the funding agency.

NTIS

Research; Experimentation; Experiment Design; Data Processing; Kaons

19990026602 Department of Energy, Washington, DC USA

Linear inductive voltage adders (IVA) for advanced hydrodynamic radiography

Mazarakis, M. G., Department of Energy, USA; Boyes, J. D., Department of Energy, USA; Johnson, D. L., Department of Energy, USA; Dec. 31, 1998; 3p; In English; 19th; Meeting sponsored in part by Linac

Report No.(s): DE98-006232; SAND-98-0900C; CONF-980827; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The electron beam which drifts through the multiple cavities of conventional induction linacs (LIA) is replaced in an IVA by a cylindrical metal conductor which extends along the entire length of the device and effectuates the addition of the accelerator cavity voltages. In the approach to radiography, the linear inductive voltage adder drives a magnetically immersed electron diode with a millimeter diameter cathode electrode and a planar anode/bremsstrahlung converter. Both anode and cathode electrodes are immersed in a strong (15--50 T) solenoidal magnetic field. The electron beam cross section is approximately of the same size as the cathode needle and generates a similar size, very intense x-ray beam when it strikes the anode converter. An IVA driven diode can produce electron beams of equal size and energy as a LIA but with much higher currents (40--50 kA versus 4--5 kA), simpler hardware and thus lower cost. The authors present here first experimental validations of the technology utilizing HERMES 3 and SABRE IVA accelerators. The electron beam voltage and current were respectively of the order of 10 MV and 40 kA. X-ray doses of up to 1 kR (at) 1 m and spot sizes as small as 1.7 mm (at 200 R doses) were measured.

NTIS

Linear Accelerators; Radiography; Hydrodynamics; Electric Potential

19990026650 Department of Energy, Washington, DC USA

Proper time dependent measurement of(Delta)M(sub d) using jet charge and soft lepton flavor tagging

Aug. 31, 1998; 173p; In English

Report No.(s): DE98-058161; FNAL-98058161; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This thesis presents a proper time dependent measurement of the B(exp 0)(sub d) mixing frequency (Delta)M(sub d) using jet charge and soft lepton flavor tagging in p - (anti p) collisions at (radical)s = 1.8 TeV. The measurement uses the inclusive e and (mu) trigger data of the CDF detector from an integrated luminosity of 91 pb(-1). The proper time at decay is measured from a partial reconstruction of the B associated with the trigger lepton. The measurement of (Delta)M(sub d) yields (Delta)M(sub d) = 0.50 +/- 0.05 +/- 0.05 (bar h) ps(-1) where the first error is statistical and the second systematic. The flavor tagging methods used give a measured effective efficiency (epsilon)D(exp 2) of o Jet Charge: (epsilon)D(exp 2) (0.78 + 0.12 + 0.09) % o Soft Lepton: (epsilon)D(exp 2) (1.07 + 0.09 + 0.10) % where the first error is statistical and the second systematic.

NTIS

Time Dependence; Leptons; Marking

19990026651 Department of Energy, Office of Energy Research, Washington, DC USA

Associated Lambda production at Jefferson Lab

Niculescu, G., Department of Energy, USA; Baker, O. K., Department of Energy, USA; Avery, S., Department of Energy, USA; Dec. 31, 1997; 8p; In English; Hypernuclear and Strange Particle Physics, USA

Report No.(s): DE98-057823; ANL/PHY/CP-95280; CONF-9710193; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The H-1(e, e(prime)K(sup +))(Lambda) and H-1(e, e(prime)K(sup +)) (Sigma)(sup 0) reactions were studied as a function of the squared four- momentum-transfer, Q(exp 2), and the virtual photon polarization, (var-epsilon), thus enabling the separation of the longitudinal and transverse parts of the cross section. The existence of a sensibly large longitudinal component for the H-1(e, e(prime)K(sup +))(Lambda) reaction seems to be sustained by these data.

NTIS

Photons; Hypernuclei

19990026652 Department of Energy, Office of Energy Research, Washington, DC USA

Target-moderator-reflector performance: An instrument designer's perspective

Crawford, R. K., Department of Energy, USA; Dec. 31, 1998; 8p; In English; Cold Moderator, USA

Report No.(s): DE98-057817; ANL/IPNS/CP-95162; CONF-980924; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This paper focuses on two issues. The first of these is the necessity for close interaction between instrument designers and moderator designers. Several tools that would help facilitate this interaction are discussed. These include a database of moderator performance measurements and calculations and improved calculational capabilities that would permit rapid response to new

moderator ideas or requirements. The second issue addressed is the importance of background in determining the quality of the data, with emphasis on the idea that in many measurements parts of the pulse shape itself act as background. Examples illustrate cases in which the instruments are better off if the source produces fewer neutrons, provided the missing neutrons are eliminated from the tail of the pulse rather than from the peak.
NTIS
Targets; Moderators; Measuring Instruments

19990026668 Department of Energy, Office of Energy Research, Washington, DC USA
Search for squarks and gluinos with the D-Zero Detector
Abbott, B., Department of Energy, USA; Oct. 31, 1997; 11p; In English; 18th; 18th; Lepton Photon Interactions, USA, USA
Report No.(s): DE98-051106; FNAL/C-97/357-E; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

We report on a search for squarks and gluinos in p(anti p) collisions at (radical) s= 1.8 TeV using the D0 detector at Fermilab. Data corresponding to 79.2 +/- 4.2 /pb were examined for events with large missing transverse energy, three or more jets, and the absence of isolated leptons. No events were observed significantly in excess of Standard Model background predictions, and we place limits on the Minimal Supergravity parameters M(sub 0) and M(sub 1/2) .
NTIS
Research; Gluons; Elementary Particles

19990026673 Department of Energy, Office of Energy Research, Washington, DC USA
Initial investigations of SNS target facility accident source terms
Harrington, R. M., Department of Energy, USA; Devore, J. R., Department of Energy, USA; Beahm, E. C., Department of Energy, USA; Weber, C. F., Department of Energy, USA; Johnson, J. O., Department of Energy, USA; Dec. 31, 1998; 7p; In English; Nuclear applications of accelerator technology, USA
Report No.(s): DE98-005987; ORNL/CP-98704; CONF-980921; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Spallation Neutron Source (SNS) is a Department of Energy, accelerator- based neutron source proposed for construction at the Oak Ridge National Laboratory. The project is currently nearing the end of the conceptual design stage. The objective of the target facility is to provide beams of pulsed thermal and sub-thermal neutrons for research purposes. The neutrons are created by the action of highly energetic protons ((approximately) 1 GeV) on a mercury target. The proton beam power will be 1 MW with planned upgrades to 2 MW and, eventually, to 4 MW. Over the course of facility life, significant inventories of spallation and activation products will build up in the target mercury. Accordingly, the facility is being designed to prevent or minimize potential environmental source terms. The results of calculations of the SNS target mercury radionuclide inventories and the characteristics of the dominant radionuclides are presented. The effect of the activation/spallation product chemical and physical characteristics on dispersability is discussed. Energy sources that could drive potential releases, credible initiating events and facility preventive and mitigative features are described. The source term for the limiting extremely unlikely mercury spill accident scenario is presented. These results support the conclusion that the facility has a low hazard profile with regard to the accidental release of radioactive material.
NTIS
Radioactive Isotopes; Radioactive Materials; Design Analysis; Research Facilities; Neutron Sources

19990026680 Department of Energy, Office of Energy Research, Washington, DC USA
Performances of BNL high-intensity synchrotrons
Weng, W. T., Department of Energy, USA; Mar. 31, 1998; 7p; In English; 1st; Asian Particle Accelerator, USA
Report No.(s): DE98-004629; BNL-65318; CONF-980359; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The AGS proton synchrotron was completed in 1960 with initial intensity in the 10(exp 10) proton per pulse (ppp) range. Over the years, through many upgrades and improvements, the AGS now reached an intensity record of 6.3 x 10(exp 13) ppp, the highest world intensity record for a proton synchrotron on a single pulse basis. At the same time, the Booster reached 2.2 x 10(exp 13) ppp surpassing the design goal of 1.5 x 10(exp 13) ppp due to the introduction of second harmonic cavity during injection. The intensity limitation caused by space charge tune spread and its relationship to injection energy at 50 MeV, 200 MeV, and 1,500 MeV will be presented as well as many critical accelerator manipulations. BNL currently participates in the design of an

accumulator ring for the SNS project at Oak Ridge. The status on the issues of halo formation, beam losses and collimation are also presented.
NTIS
Proton Beams; Synchrotrons; Performance Prediction; Laboratories; Particle Acceleration

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OPTICS

Includes light phenomena; and optical devices. For lasers see 36 Lasers and Masers.

19990025378 Rochester Inst. of Tech., NY USA
A Comparative Analysis of Spectral Band Selection Techniques
Laurenzano, Julia M., Rochester Inst. of Tech., USA; Jun. 1998; 220p; In English
Report No.(s): AD-A359077; AFIT-FY99-23; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

The ability to determine optimal spectral band sets for the exploitation of multispectral and hyperspectral imagery is of great concern due to data transfer, storage, and computational constraints. This study compares the performance of three band selection techniques across a range of scenarios and image exploitation algorithms. Thresholded Divergence, a technique based on Gaussian Maximum Likelihood classification, Forward Sequential Band Selection, an iterative method based on target identification algorithms, and Spectral Basis Functions, a method independent of end-exploitation, were selected for evaluation. Each of these band selection techniques was applied to two M7 multispectral images and two HYDICE hyperspectral images. Each selected optimal spectral band set for each image was classified and assessed for classification accuracy. Comparisons between band selection techniques were made based on spectral band subset size, image exploitation algorithm, image and scene type, and input parameter set.
DTIC
Spectral Bands; Image Processing; Images

19990025382 Woods Hole Oceanographic Inst., Biology Dept., MA USA
Response of Particulate Optical Properties to Coastal Mixing Processes ***Progress Report, 1 Feb. 1998 - 31 Jan. 1999***
Sosik, Heidi M., Woods Hole Oceanographic Inst., USA; Olson, Robert J., Woods Hole Oceanographic Inst., USA; Jan. 31, 1999; 9p; In English
Contract(s)/Grant(s): N00014-95-1-0333
Report No.(s): AD-A359104; WHOI-2241; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Our long-term goals are to develop a better understanding of the relationships between upper ocean optical properties and particulate and dissolved seawater constituents, and to determine how these relationships are influenced by physical processes. Specific long term objectives include both predicting and modeling optical variability relevant for biological processes, such as phytoplankton photosynthesis, and retrieval of information about the biomass and activity of plankton from optical measurements.
DTIC
Particulates; Optical Properties; Marine Biology

19990025460 Alabama Univ., Center for Applied Optics, Huntsville, AL USA
Practice Oriented Master's in Optics ***Final Report, 18 Mar. 1997 - 17 Mar. 1998***
Dimmock, John O., Alabama Univ., USA; May 04, 1998; 124p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG8-1028; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The development of an interdisciplinary Masters Program with a concentration in Optics and Photonics Technology has been is described. This program was developed under the U.S. Manufacturing Education and Training Activity of the Technology Reinvestment Project. This development was a collaboration between the University of Alabama in Huntsville (UAH), Alabama A&M University, Northwest Shoals Community College, the NASA Marshall Space Flight Center (MSFC), the U.S. Army Missile Command, Oak Ridge National Laboratory (ORNL), Advanced Optical Systems Inc., Dynetics, Inc., Hughes Danbury Optical Systems, Inc., Nichols Research and Speedring Inc. These organizations as well as the National Institute for Standards and Technology and SCI, Inc. have been participating fully in the design, development and implementation of this program. This goal of the program is to produce highly trained graduates who can also solve practical problems. to this end, the program includes an on-site practicum at a manufacturing location. The broad curriculum of this program emphasizes the fundamentals of optics, optical systems manufacturing and testing, and the principles of design and manufacturing to cost for commercial products. The Master's of Science (MS) in Physics and Master's of Science in Engineering (MSE) in Electrical Engineering Degrees with con-

centration in Optics and Photonics Technology are offered by the respective UAH academic departments with support from and in consultation with a Steering Committee composed of representatives from each of the participating organizations, and a student representative from UAH. The origins of the programs are described. The curricula of the programs is described. The course outlines of the new courses which were developed for the new curriculum are included. Also included are samples of on-site practicums which the students have been involved in. Also included as attachments are samples of the advertisements, which includes flyers, and the program description given to prospective students. The expenditures in the development and information about the cost sharing among the participating organizations is also included. Finally a listing membership of the steering committee is attached.
CASI
Education; Photonics; Optics; University Program

19990025469 NASA Goddard Space Flight Center, Greenbelt, MD USA
Thermal Control Using Electrochromism
Vaidyanathan, Hari, Communications Satellite Corp., USA; Rao, Gopalakrishna, NASA Goddard Space Flight Center, USA; 1998; 15p; In English; Aerospace Battery Workshop, 27-29 Oct. 1998, Huntsville, AL, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The applicability of a charge balanced electrochromic device to modulate the frequencies in the thermal infra red region is examined in this study. The device consisted of a transparent conductor, WO3 anode, PMMA/LiClO4, electrolyte, V2O5, cathode and transparent conductor. The supporting structure in the device is SnO2 coated glass and the edges are sealed with epoxy to reduce moisture absorption. The performance evaluation comprised of cyclic voltammetric measurements and determination of transmittance at various wavelengths. The device was subjected to anodic and cathodic polarization by sweeping the potential at a rate of 10 mV/sec from -0.8 V to 1.8 V. The current versus voltage profile indicated no reaction between -0.5 and +0.5 V. The device is colored green at 1.8 V with a transmittance of 5% at a wavelength, lambda = 900 nm and colorless at -0.8 V with a transmittance of 74% at X = 500 nm. The optical modulation is limited to 400-1500 nm and there is no activity in the thermal infrared. The switching time is 75 seconds for transmittance to decrease from 74% to 50%. The device yielded reproducible values for transmittance when cycled between colored and bleached states by application of 1.8 V and -0.8 V, respectively.
Author
Temperature Control; Electrochromism; Infrared Radiation

19990025473 Texas A&M Univ., Dept. of Physics, College Station, TX USA
Fundamental and Applied Quantum Optics ***Final Report***
Scully, Marlan O., Texas A&M Univ., USA; Nov. 03, 1998; 14p; In English
Contract(s)/Grant(s): N00014-96-1-0126
Report No.(s): AD-A358794; 97PR01406-0; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Coherence effects in quantum optics have been recently demonstrated to yield: lasing without inversion, ultra large linear and nonlinear susceptibilities accompanied by suppressed absorption as well as ultra high precision spectroscopy. With ”in-principle” theory and proof of principle experiments in hand we are now pushing toward deeper understanding of the basic physics and practical realization of these advances.
DTIC
Quantum Optics; Quantum Theory

19990025623 NASA Goddard Space Flight Center, Greenbelt, MD USA
Spaceborne Fiber Optic Data Bus (SFODB)
Bretthauer, Joy W., NASA Goddard Space Flight Center, USA; Chalfant, Chuck H., Optical Networks, Inc., USA; Orlando, Fred J., Orlando and Associates, USA; Parkerson, P., Arkansas Univ., USA; Rezek, Ed, TRW, Inc., USA; Sawyer, Marc, Broadband Communications Products, USA; 1999; 8p; In English; Government Microelectronics and Applications Conference (GOMAC), 8-11 Mar. 1999, Monterey, CA, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Spaceborne Fiber Optic Data Bus (SFODB) is an IEEE 1393 compliant, gigabit per second, fiber optic network specifically designed to support the real-time, on-board data handling requirements of remote sensing spacecraft. The network is fault tolerant highly reliable, and capable of withstanding the rigors of launch and the harsh space environment. SFODB achieves this operational and environmental performance while maintaining the small size, light weight, and low power necessary for spaceborne applications. On December 9, 1998, SFODB was successfully demonstrated at NASA’s Goddard Space Flight Center (GSFC).
Author
Remote Sensing; Fiber Optics; Fault Tolerance; Aerospace Environments

19990025768 Naval Postgraduate School, Monterey, CA USA
Amplitude Modulation Using a Nonlinear Optical Loop Mirror
Grennek, David S.; Dec. 1998; 58p; In English
Report No.(s): AD-A358980; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The nonlinear optical loop mirror (NOLM) configuration has been studied extensively within the context of pulsed and/or quasi-CW laser sources. As such, the NOLM holds great promise in the areas of soliton switching, pulse compression and high data rate communications. However, comparatively little research has been done with CW sources. In this investigation, the theoretical properties of the NOLM are explored experimentally with the aid of a CW Nd:YAG laser operating in the infrared region. Specifically, the nonlinear effects of self-phase modulation are characterized. For a beam of sufficient intensity, its optical path through the fiber may be altered due to the dependence of the phase on intensity. Thus, two coherent beams of light of differing intensity can be made to interfere constructively or destructively even though the physical paths are identical. In the NOLM configuration, the potential result is an amplitude modulated output beam exhibiting a repetition rate several orders of magnitude greater than that of the input. Two dissimilar single-mode fibers as well as two custom-built fixed-ratio asymmetric fiberoptic couplers are utilized in the experiment. Correlation with theory is emphasized and follow-on projects are discussed.
DTIC
Amplitude Modulation; Asymmetry; Coherent Light; Continuous Radiation; Continuous Wave Lasers; Couplers; Fiber Optics; Infrared Radiation

19990025965 Optical Society of America, Washington, DC USA
Special Session on Adaptive Optics in Russia and China, Volume 23
Jan. 1995; 298p; In English, 2-6 Oct. 1995, Garching, Germany
Contract(s)/Grant(s): F61708-95-W-0433
Report No.(s): AD-A359196; EOARD-CSP-95-1047; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

The report documents the summaries of the papers presented at the topical meeting on Adaptive Optics held 2-6 October 1995 in Garching, Germany. The purpose of the present report was to address both basic and applied research issues regarding science and technology with particular attention to nonlinear optics, imaging, adaptive optics and computational methods.
DTIC
Adaptive Optics; Imaging Techniques; Nonlinear Optics; Research and Development

19990026109 Air Force Research Lab., Directed Energy Directorate, Kirkland AFB, NM USA
Applications of Power Series Solutions of Membrane Equilibrium Equations to the Optical Evaluation of Membrane Mirrors with Curvature ***Final Report, Dec. 1997 - Dec. 1998***
Wilkes, James M.; Dec. 1998; 34p; In English
Contract(s)/Grant(s): AF Proj. 3326
Report No.(s): AD-A359549; AFRL-DE-PS-TR-1998-1069; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Power series solutions of the Hencky-Campbell equilibrium equations for an initially planar circular membrane in a state of uniform pre-strain are used to analyze the performance of an in-house laboratory membrane mirror curved by a uniform vacuum pressure applied to one side. The results provide theoretical verification of the improvement in surface figure achievable by controlling the amount of pre-strain. In particular, a pre-strain of only 0.25%, corresponding to a uniform radial displacement of the edge of an 11-inch diameter membrane mirror by about 0.014 inches, is predicted to achieve nearly 95% reduction in the maximum deviation of an f/8 membrane from a reference sphere. These results are in good agreement with laboratory measurements of spherical aberration using a Hartmann wavefront sensor. The model was also used in an extensive investigation of the effects of control parameters (pressure and pre-strain) on the improvement of surface figure for lower f-number systems. The results indicate that comparable improvement in systems of f-number less than f/6 would require membrane materials capable of withstanding pre-strains on the order of 2.0% or greater.
DTIC
Mirrors; Boundary Value Problems; Axial Loads; Power Series; Equilibrium Equations; Membrane Structures

19990026463 Department of the Navy, Washington, DC USA
Optical Fiber Terminations
Busse, Lynda E., Inventor; Kung, Frederic H., Inventor; Sanghera, Jasbinder S., Inventor; Aggarwal, Ishwar D., Inventor; Jul. 07, 1998; 13p; In English
Patent Info.: Filed 30 Oct. 96,; US-Patent-Appl-SN-739,985; US-Patent-5,778,125
Report No.(s): AD-D019225; No Copyright; Avail: US Patent and Trademark Office, Microfiche

An optical fiber termination connector includes an elongated structure with a chamber extending therethrough open at both ends, a fiber disposed in the chamber and spaced therefrom, a solid first material disposed in the chamber around the fiber, and an air gap in the chamber around the end of the fiber. The process includes the steps of locating a fiber in a chamber disposed vertically, with the end of the fiber extending beyond the lower portion of chamber: dipping a lower portion of the chamber into a first material in liquid from so that the first material enters the lower portion of the chamber to a level below an exit port located in the lower portion of the chamber: solidifying the first material disposed in and around the chamber and the fiber; above the solid first material: polishing the lower end of the fiber until it is flush with the chamber at the lower thereof: and removing the first material to form an air gap between the fiber and the lower portion of the chamber. The air gap is large enough to allow independent thermal expansion of the fiber.
DTIC
Fiber Optics; Thermal Expansion; Optical Fibers; Connectors

19990026623 Department of the Navy, Washington, DC USA
Optical Limiter Structure and Method
Snow, Arthur W., Inventor; Shirk, James S., Inventor; Bartoli, Filbert J., Jr., Inventor; Lindle, James R., Inventor; Boyle, Michael E., Inventor; Sep. 08, 1998; 11p; In English; Supersedes US-Patent-Appl-SN-239-068, AD-D016327.
Patent Info.: Filed 6 May 94,; US-Patent-Appl-SN-239,068; US-Patent-5,805,326
Report No.(s): AD-D019184; No Copyright; Avail: US Patent and Trademark Office, Microfiche
An optical limiter structure which includes a limiter material preferably dissolved in a host. The limiter material is selected from substituted and unsubstituted phthalocyanines, naphthalocyanines, porphyrins, salts of these materials and mixtures thereof, whereas the host is selected from any material which can dissolve the limiter material to at least the extent of 0.1% by weight.
DTIC
Optical Filters; Dissolving

75
PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see 46 Geophysics. For space plasmas see90 Astrophysics.

19990025203 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China
Plasma Induced Wafer Charging Sensor
McVittie, James P., Stanford Univ., USA; Ma, Shawming, Hewlett-Packard Co., USA; Journal of the Chinese Institute of Engineers: Transactions of the Chinese Institute of Engineers, Series A; January 1998; ISSN 0253-3839; Volume 21, No. 1, pp. 11-19; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
An on-wafer surface charging sensor was developed for real-time measurement of the local charging voltage during plasma processing. This sensor is based on a modified MOS capacitor structure with charging voltage built up between an electrode and the substrate across a thick oxide as an indicator of charging. An array of electrodes are designed to measure the local plasma charging condition across the wafer. The processes needed for this sensor manufacturing are fully compatible with present CMOS processes. Comparisons between different characterization methods of plasma charging are also discussed. This sensor can differentiate the charging condition for different process stages (on-transient, steady state, off-transient). In addition, this sensor provides a faster reading method of charging without further device measurements after plasma processing. From the experimental results of probe measurements in Ar, SF6 and C2ClF5 plasma, this probe shows excellent capability on real-time monitoring of charging voltage. This sensor can be applied to IC plasma processing and equipment development, and trouble shooting in the future.
Author
Plasmas (Physics); Electric Charge; In Situ Measurement; Capacitors; Wafers; Integrated Circuits; Sensors; Electrical Measurement

19990025257 Naval Research Lab., Washington, DC USA
Space Chamber Simulation of Altitude Variation on Plasma Wave Signatures ***Interim Report***
Amatucci, William E.; Walker, David; Ganguli, Guru; Dec. 02, 1998; 14p; In English
Report No.(s): AD-A359314; NRL/MR/6755--98-8319; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The effects of increasing ion-neutral collisions on velocity-shear-driven ion cyclotron waves have been studied in simulated ionospheric conditions in the Naval Research Laboratory's Space Physics Simulation Chamber. The experiments show that shear-driven ion cyclotron waves can exist for ion-neutral collision frequencies of the order of the ion gyrofrequency. For higher collision frequencies where the ions become unmagnetized, a transition to a higher frequency mode is observed.
DTIC
Plasma Waves; Atmospheric Physics; Ion Cyclotron Radiation; Signatures; Simulation; Collision Rates

19990025296 Iowa Univ., Dept. of Physics and Astronomy, Iowa City, IA USA
Principles of Space Plasma Wave Instrument Design
Gurnett, Donald A., Iowa Univ., USA; Measurement Techniques in Space Plasmas: Fields: Geophysical Monograph 103; 1998, 103, pp. 121-136; In English
Contract(s)/Grant(s): JPL-958779; Copyright; Avail: Issuing Activity (Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA), Hardcopy, Microfiche
Space plasma waves span the frequency range from somewhat below the ion cyclotron frequency to well above the electron cyclotron frequency and plasma frequency. Because of the large frequency range involved, the design of space plasma wave instrumentation presents many interesting challenges. This chapter discusses the principles of space plasma wave instrument design. The topics covered include: performance requirements, electric antennas, magnetic antennas, and signal processing. Where appropriate, comments are made on the likely direction of future developments.
Author
Space Plasmas; Cyclotron Frequency; Ion Cyclotron Radiation; Plasma Frequencies; Plasma Waves

19990025764 Maryland Univ., Lab. for Plasma Research, College Park, MD USA
High resolution Plasma diagnostics for High Power Microwave (HPM) Generation Research ***Final Report, 1 Aug. 1996 - 31 Jul. 1998***
Granatstein,; Dec. 1998; 14p; In English
Contract(s)/Grant(s): F49620-96-1-0391
Report No.(s): AD-A358921; AFRL-SR-BL-TR-98-0860; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
As proposed, we purchased the following three diagnostics systems: (1) Dual pulsed dye laser system, streak and framing camera and associated accessories. (2) Streak and framing camera and associated accessories. (3) Diagnostics and design of a long pulse (1 microsec) field emission electron gun with stable cross section for HPM sources.
DTIC
Diagnosis; Dye Lasers; Electron Guns; Field Emission; Framing Cameras; High Resolution

19990025904 Department of Energy, Office of Energy Research, Washington, DC USA
Critical edge parameters for H-mode transition in DIII-D
Groebner, R. J., Department of Energy, USA; Carlstrom, T. N., Department of Energy, USA; Nov. 30, 1997; 8p; In English; H-Mode physics
Report No.(s): DE98-001854; GA-A22723; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Measurements in DIII-D of edge ion and electron temperatures T(sub i) and T(sub e) just prior to the transition to H-mode are presented. A fitting model based on a hyperbolic tangent function is used in the analysis. The edge temperatures are observed to increase during the L-phase with the application of auxiliary heating. The temperature rise is small if the H-mode power threshold is close to the Ohmic power level in the absence of auxiliary heating and is large if the H-mode threshold is well above the Ohmic power level. The edge temperatures just prior to the transition are approximately proportional to the toroidal magnetic field Bt for the field either in the reversed or forward direction. However, for the reversed magnetic field, the temperatures are at least a factor of two higher than for the forward direction.
NTIS
Modes; Electron Energy; Ion Temperature

19990025935 Washington Univ., Aerospace and Energetics Research Program, Seattle, WA USA
Development of an Advanced Implicit Algorithm for MHD Computations on Parallel Supercomputers ***Final Report, 1 May 1996 - 30 Apr. 1998***
Shumlak, Uri; Jul. 28, 1998; 68p; In English
Contract(s)/Grant(s): F49620-96-1-0160; AF Proj. 2304
Report No.(s): AD-A359534; AFRL-SR-BL-TR-99-0023; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The primary objective of this project is to develop an advanced algorithm for parallel supercomputers to model time-dependent magnetohydrodynamics (MHD) in all three dimensions. This will provide a valuable tool for the design and testing of plasma related technologies that are important to the Air Force and industry. Implementing the algorithm on parallel supercomputers will allow the detailed modeling of realistic plasmas in complex three-dimensional geometries. We have developed a time-dependent, two-dimensional, arbitrary-geometry version of the algorithm, placed it into a testbed code, added the modifications necessary for viscous and resistive effects, and tested the code against known analytical problems. We have implemented the algorithm on a parallel architecture and investigated parallelization strategies. Future plans include installing the algorithm into MACH2, optimizing the parallelization, extending the code to three dimensions, installing the three-dimensional algorithm into MACH3, and calibrating the code with experimental data.
DTIC
Magnetohydrodynamics; Algorithms; Parallel Processing (Computers); Supercomputers; Viscous Flow; Flow Visualization

19990025967 Department of Energy, Washington, DC USA
Effects of ExB Velocity Shear and Magnetic Shear in the Formation of Core Transport Barriers in the DIII-D Tokamak
Burrell, K. H., Department of Energy, USA; Greenfield, C. M., Department of Energy, USA; Lao, L. L., Department of Energy, USA; Staebler, G. M., Department of Energy, USA; Austin, M. E., Department of Energy, USA; Dec. 31, 1997; 22p; In English; 6th; H-mode physics
Report No.(s): DE98-001906; GA-A22715; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Core transport barriers can be reliably formed in DIII-D by tailoring the evolution of the current density profile. This paper reports studies of the relative role of magnetic and ExB shear in creating core transport barriers in the DIII-D tokamak and considers the detailed dynamics of the barrier formation. The core barriers seen in DIII-D negative shear discharges form in a stepwise fashion during the initial current ramp. The reasons for the stepwise formation is not known; these steps do not correlate with integer values of q(O) or minimum q. The data from DIII-D is consistent with previous results that negative magnetic shear facilitates the formation of core transport barriers in the ion channel but is not necessary. However, strongly negative magnetic shear does allow formation of transport barriers in particle, electron thermal, ion thermal and angular momentum transport channels. Shots with strong negative magnetic shear have produced the steepest ion temperature and toroidal rotation profiles seen yet in DIII-D. In addition, the ExB shearing rates seen in these shots exceed the previous DIII-D record value by a factor of four.
NTIS
Velocity; Barriers; Electromagnetic Fields; Shears; Cores

19990025968 Department of Energy, Office of Energy Research, Washington, DC USA
H-mode pedestal characteristics, ELMs, and energy confinement in ITER shape discharges on DIII-D
Osborne, T. H., Department of Energy, USA; Groebner, R. J., Department of Energy, USA; Lao, L. L., Department of Energy, USA; Leonard, A. W., Department of Energy, USA; Miller, R. L., Department of Energy, USA; Dec. 31, 1997; 15p; In English; H-mode physics
Report No.(s): DE98-001905; GA-A22733; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The H-mode confinement enhancement factor, H, is found to be strongly correlated with the height of the edge pressure pedestal in ITER shape discharges. In discharges with Type I ELMs the pedestal pressure is set by the maximum pressure gradient before the ELM and the width of the H-mode transport barrier. The pressure gradient before Type I ELMs is found to scale as would be expected for a stability limit set by ideal ballooning modes, but with values significantly in excess of that predicted by stability code calculations. The width of the H-mode transport barrier is found to scale equally well with pedestal P(POL)(2/3) or B(POL)(1/2). The improved H value in high B(POL) discharges may be due to a larger edge pressure gradient and wider H-mode transport barrier consistent with their higher edge ballooning mode limit. Deuterium puffing is found to reduce H consistent with the smaller pedestal pressure which results from the reduced barrier width and critical pressure gradient. Type I ELM energy loss is found to be proportional to the change in the pedestal energy.
NTIS
Energy Dissipation; Confinement

19990025993 Department of Energy, Office of Energy Research, Washington, DC USA
Divertor Materials Evaluation System (DiMES)
Wong, C. P., Department of Energy, USA; West, W. P., Department of Energy, USA; Whyte, D. G., Department of Energy, USA; Bastasz, R. J., Department of Energy, USA; Brooks, J., Department of Energy, USA; Nov. 30, 1997; 18p; In English; 8th; Fusion Reactor Materials
Report No.(s): DE98-002634; GA-A22743; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The mission of the Divertor Materials Evaluation System (DiMES) in DIII-D is to establish an integrated data base from measurements in the divertor of a tokamak in order to address some of the ITER and fusion power reactor plasma material interaction issues. Carbon and metal coatings of Be, W, V, and Mo were exposed to the steady-state outer strike point on DIII-D for 4-18 s. These short exposure times ensure controlled exposure conditions, and the extensive arrays of DIII-D divertor diagnostics provide a well-characterized plasma for modeling efforts. Postexposure analysis provides a direct measure of surface material erosion rates and the amount of retained deuterium. For carbon, these results match closely with the results of accumulated carbon deposition and erosion, and the corresponding deuterium retention of long term exposure tiles in DIII-D. Deuterium retention of different materials was measured using the He-3(d,p) He-4 nuclear reaction. For carbon, these measurements showed peak deuterium areal density of about 8 x 10 (exp 18) D/sq cm in a co-deposited layer about 6 micro-m deep, mainly at the usually detached inboard divertor leg. That layer of carbon near the inner divertor strike point has an atomic saturation concentration of D/C approximately 0.25, which is not significantly lower than the laboratory-measured saturation retention of 0.4. Under the carbon contaminated background plasma of DIII-D, metal coatings of Be, V, Mo, and W were exposed to the steady state outer strike point under ELMing and ELM-free H-mode discharges. The rate of material erosion and tritium retention were measured. As expected, W shows the lowest erosion rate at 0.1 nm/s and the lowest deuterium uptake.
NTIS
Divertors (Fusion Reactors); Fusion Reactors; Reactor Materials

19990025994 Department of Energy, Office of Energy Research, Washington, DC USA
Power and particle exhaust in tokamaks
Stambaugh, R. D., Department of Energy, USA; Jan. 31, 1998; 10p; In English; 17th; Fusion Engineering
Report No.(s): DE98-002635; GA-A22794; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The status of power and particle exhaust research in tokamaks is reviewed in the light of ITER requirements. There is a sound basis for ITER's nominal design positions; important directions for further research are identified.
NTIS
Tokamak Devices; Exhaust Systems; Fusion Reactors

19990026059 Department of Energy, Office of Energy Research, Washington, DC USA
Analysis of D pellet injection experiments in the W7-AS Stellarator
Lyon, J. F., Department of Energy, USA; Baylor, L. R., Department of Energy, USA; Baldzuhn, J., Department of Energy, USA; Fiedler, S., Department of Energy, USA; Hirsch, M., Department of Energy, USA; Jul. 31, 1997; 7p; In English; 24th; Controlled Fusion and Plasma Physics, USA
Report No.(s): DE97-008549; CONF-9706131-25; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
A centrifugal injector was used to inject deuterium pellets (with 3--5 x 10(sup 19) atoms) at approx. equal 600 m/s into current-less, nearly shear-less plasmas in the Wendelstein 7-AS (W7-AS) stellarator. The D pellet was injected horizontally at a location where the non-circular and non-axisymmetric plasma cross section is nearly triangular. Visible-light TV pictures usually showed the pellet as a single ablating mass in the plasma, although the pellet occasionally broke in two or splintered into a cloud of small particles. The density evolution following pellet injection and the effect of pellet injection on energy confinement and fluctuations are discussed.
NTIS
Plasma Diagnostics; Deuterium; Pellets; Injection; Thermonuclear Reactions

19990026065 Department of Energy, Office of Energy Research, Washington, DC USA
Physics of High Performance Dueterium-Tritium Plasmas in TFTR
McGuire, K. M., Department of Energy, USA; Dec. 31, 1996; 19p; In English; 16th; Plasma Physics and Controlled Nuclear Fusion Research, USA; Sponsored by International Atomic Energy Agency, Austria
Report No.(s): DE97-009363; CONF-961005-35; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
During the past two years, deuterium-tritium (D-T) plasmas in the Tokamak Fusion Test Reactor (TFTR) have been used to study fusion power production, isotope effects associated with tritium fueling, and alpha-particle physics in several operational regimes. The peak fusion power has been increased to 10.7 MW in the supershot mode through the use of increased plasma current and toroidal magnetic field and extensive lithium wall conditioning. The high- internal-inductance (high -li) regime in TFTR has been extended in plasma current and has achieved 8.7 MW of fusion power. Studies of the effects of tritium on confinement have now been carried out in ohmic, NBI- and ICRF-heated L-mode and reversed-shear plasmas. In general, there is an enhancement in confinement time in D-T plasmas which is most pronounced in supershot and high- li discharges, weaker in L-mode plasmas with NBI and ICRF heating and smaller still in ohmic plasmas. In reversed-shear discharges with sufficient deuterium- NBI heat-

ing power, internal transport barriers have been observed to form, leading to enhanced confinement. Large decreases in the ion heat conductivity and particle transport are inferred within the transport barrier.It appears that higher heating power is required to trigger the formation of a transport barrier with D-T NBI and the isotope effect on energy confinement is nearly absent in these enhanced reverse-shear plasmas. Many alpha-particle physics issues have been studied in the various operating regimes including confinement of the alpha particles, their redistribution by sawteeth, and their loss due to MHD instabilities with low toroidal mode numbers. In weak-shear plasmas, alpha- particle destabilization of a toroidal Alfven eigenmode has been observed.
NTIS
Plasma Control; Tritium; Alpha Particles; Deuterium Plasma; Fusion Reactors; Ion Cyclotron Radiation; Magnetohydrodynamic Stability; Plasma Heating; Tokamak Devices; Toroidal Plasmas

19990026138 Department of Energy, Office of Energy Research, Washington, DC USA
Preliminary Master Logic Diagram for ITER operation
Cadwallader, L. C., Department of Energy, USA; Taylor, N. P., Department of Energy, USA; Poucet, A. E., Department of Energy, USA; Apr. 30, 1998; 8p; In English; Probabilistic safety assessment and management (PSAM4)
Report No.(s): DE98-054119; INEEL/CON-97-01165; CONF-980907; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This paper describes the work performed to develop a Master Logic Diagram (MLD) for the operations phase of the International Thermonuclear Experimental Reactor (ITER). The MLD is a probabilistic risk assessment tool used to identify the broad set of potential initiating events that could lead to an offsite radioactive or toxic chemical release from the facility under study. The MLD described in this paper is complementary to the failure modes and effects analyses (FMEAs) that have been performed for ITER's major plant systems in the engineering evaluation of the facility design. While the FMEAs are a bottom-up or component level approach, the MLD is a top-down or facility level approach to identifying the broad spectrum of potential events. Strengths of the MLD are that it analyzes the entire plant, depicts completeness in the accident initiator process, provides an independent method for identification, and can also identify potential system interactions. MLDs have been used successfully as a hazard analysis tool. This paper describes the process used for the ITER MLD to treat the variety of radiological and toxicological source terms present in the ITER design. One subtree of the nineteen page MLD is shown to illustrate the levels of the diagram.
NTIS
Thermonuclear Reactions; Logic Design; Systems Engineering

19990026214 Department of Energy, Office of Energy Research, Washington, DC USA
Laser Metrology/Viewing System for ITER In-Vessel Inspection
Spampinato, P. T., Department of Energy, USA; Barry, R. E., Department of Energy, USA; Chesser, J. B., Department of Energy, USA; Menon, M. M., Department of Energy, USA; Dagher, M. A., Department of Energy, USA; Oct. 31, 1997; 7p; In English; 17th; Fusion engineering; Sponsored by Institute of Electrical and Electronics Engineers, USA; Meeting sponsored in part by NPSS
Report No.(s): DE97-008902; ORNL/CP-94832; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This paper identifies the requirements for a remotely operated precision laser ranging system for the International Thermonuclear Experimental Reactor. The inspection system is used for metrology and viewing, and must be capable of achieving submillimeter accuracy and operation in a reactor vessel that has high gamma radiation, high vacuum, elevated temperature, and magnetic field levels. A coherent, frequency modulated laser radar system is under development to meet these requirements. The metrology/viewing sensor consists of a compact laser-optic module linked through fiberoptics to the laser source and imaging units, located outside the harsh environment. The deployment mechanism is a remotely operated telescopic mast. Gamma irradiation up to 10(exp 7) Gy was conducted on critical sensor components with no significant impact to data transmission, and analysis indicates that critical sensor components can operate in a magnetic field with certain design modifications. Plans for testing key components in a magnetic field are underway.
NTIS
Lasers; Laser Outputs; Inspection; Vessels; Metrology

19990026246 Department of Energy, Washington, DC USA
NIF Project Management System Description
Wolfe, C. R., Department of Energy, USA; Aug. 01, 1997; 19p; In English
Report No.(s): DE98-051263; UCRL-ID-128283; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This document has been prepared for two purposes: 1. to demonstrate compliance with the project management requirements of DOE Order 430. 1, Life- Cycle Asset Management (LCAM). 2. to summarize in one place the approved Project documents which, taken as a whole, describe the NIF Project Management System.
NTIS
Management Systems; Project Management

19990026267 Department of Energy, Washington, DC USA
Target/Blanket Design for the Accelerator Production of Tritium Plant
Cappiello, M., Department of Energy, USA; Dec. 31, 1997; 10p; In English, USA; Sponsored by American Nuclear Society, USA
Report No.(s): DE97-008972; LA-UR-97-2586; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Accelerator Production of Tritium Target/Blanket (T/B) system is comprised of the T/B assembly and the attendant heat removal systems. The T/B assembly produces tritium using a high energy proton beam, and a spallation neutron source. The supporting heat removal systems safely remove the heat deposited by the proton beam during both normal and off-normal conditions. All systems reside within the T/B building, which is located at the end of a linear accelerator. Protons are accelerated to an energy of 1700 MeV at a current of 100 mA and are directed onto the T/B assembly. The protons interact with tungsten and lead nuclei to produce neutrons through the process of nuclear spallation. Neutron capture in He-3 gas produces tritium which is removed on a continual basis in an adjacent Tritium Separation Facility (TSF). The T/B assembly is modular to allow for replacement of spent components and minimization of waste. Systems and components are designed with safety as a primary consideration to minimize risk to the workers and the public.
NTIS
Targets; Tritium; Linear Accelerators; Blankets; Design Analysis

19990026376 Department of Energy, Washington, DC USA
Directions of ICF research in the USA
Hogan, W. J., Department of Energy, USA; Campbell, M. A., Department of Energy, USA; Aug. 01, 1997; 11p; In English; 13th; Laser Interaction and Related Plasma Phenomena, USA
Report No.(s): DE98-051264; UCRL-JC-128281; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Inertial Confinement Fusion (ICF) research in the USA is in a dramatic upswing. Technical progress continues at a rapid pace and with the start of construction of the National Ignition Facility (NIF) this year the total U.S. budget for ICF for fiscal year 1997 stands at $380 million. The NIF is being built as an essential component of the U.S. Stockpile Stewardship and Management Program, which has been formulated to assure the continued safety, reliability and performance of the downsized nuclear weapons stockpile in the absence of nuclear tests. Thus the increase in funding originates in the Congressional armed services committees and is managed by Defense Programs of the Department of Energy. The NIF, however, is a fundamental research tool that will be of great benefit beyond its mission within the nuclear weapons program. Its experiments will promote fusion energy development and will open new areas of basic scientific research. This paper will discuss some of the directions that ICF research is now taking, the progress on the NIF Project, and the potential impact that these developments are likely to have on fusion energy development and on certain areas of the basic sciences.
NTIS
Research Facilities; Fabrication; Inertial Confinement Fusion; Construction; Research Management

19990026378 Department of Energy, Washington, DC USA
National Ignition Facility sub-system design requirements integrated timing system SSDR 1.5.3
Wiedwald, J., Department of Energy, USA; VanAersau, P., Department of Energy, USA; Bliss, E., Department of Energy, USA; Aug. 26, 1996; 19p; In English
Report No.(s): DE98-050892; UCRL-ID-126980-REV.2; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This System Design Requirement document establishes the performance, design, development, and test requirements for the Integrated Timing System, WBS 1.5.3 which is part of the NIF Integrated Computer Control System (ICCS). The Integrated Timing System provides all temporally-critical hardware triggers to components and equipment in other NIF systems.
NTIS
Specifications; Research Facilities; Ignition; Plant Design; Performance Prediction; Fabrication

19990026381 Department of Energy, Washington, DC USA

Analysis of integrating sphere performance for IR enhanced DT layering

Stephens, R. B., Department of Energy, USA; Collins, G. W., Department of Energy, USA; Jun. 01, 1997; 9p; In English; 11th; Target Fabrication Specialist Meeting, USA

Report No.(s): DE98-050880; UCRL-JC-127476; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Absorbed IR energy can supplement the beta decay energy from DT ice to improve the driving force toward uniform layers. A significant problem with this approach has been to deliver the added IR energy with sufficient uniformity to enhance rather than destroy the uniformity of the ice layers. Computer modeling has indicated that one can achieve (approximately)1% uniformity in the angular variation of the absorbed power using an integrating sphere containing holes large enough to allow external inspection of the ice layer uniformity. The power required depends on the integrating sphere size, a 25 mm diameter sphere requires (approximately)35 mW of IR to deposit as much energy in the ice as the 50 mW/cu cm (35 pW total) received from tritium decay in DT. Power absorbed in the plastic can cause unacceptable ice-layer non- uniformities for the integrating sphere design considered here.

NTIS

Laser Targets; Conferences; Beta Particles; Ice; Radioactive Decay; Diagnosis

19990026384 Department of Energy, Washington, DC USA

Relativistic self-focusing in underdense plasma

Feit, M. D., Department of Energy, USA; Garrison, J. C., Department of Energy, USA; Komashko, A., Department of Energy, USA; Musher, J. L., Department of Energy, USA; Rubenchik, A. M., Department of Energy, USA; Apr. 24, 1997; 18p; In English; 13th; Laser Interaction and Related Plasma Phenomena, USA

Report No.(s): DE98-050868; UCRL-JC-127277; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In the present paper, we discuss light self-focusing in underdense (n< n(sub c)) plasmas. We will show that ion motion is important even for picosecond pulse durations and a description of relativistic self-focusing including ion dynamics will be presented in second part of the paper. In particular, we will demonstrate the formation of empty, wide channels in underdense plasma in the wake of the laser pulse. we discuss the applicability of our results to real situations and possible consequences for the ''Fast Ignitor'' project.

NTIS

Plasma Density; Conferences; Relativistic Plasmas; Self Focusing; Picosecond Pulses

19990026388 Department of Energy, Washington, DC USA

Experimental study of the richtmyer-meshkov instability, including amplitude and wave length variations

Logory, L. M., Department of Energy, USA; Miller, P. L., Department of Energy, USA; Peyser, T. A., Department of Energy, USA; Murray, S. D., Department of Energy, USA; Farley, D. R., Department of Energy, USA; Jun. 12, 1997; 9p; In English

Report No.(s): DE98-050758; UCRL-JC-127665; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

We report on results of an experimental study of the Richtmyer-Meshkov instability. The growth of the mixing region in the nonlinear regime is measured for a set of cases in which the amplitude and wavelength of the initial perturbation are varied systematically. The experiments are conducted on the Nova laser facility, and use a Nova hohlraum as a driver source to launch a high-Mach number shock into a miniature shock tube attached to the hohlraum. The shock tube contains brominated plastic and low density carbon foam as the two working fluids, with a micro-machined, triangular sawtooth interface between them serving as the initial perturbation. The sawtooth perturbation waveform is dominated by a single mode, and the perturbation amplitudes are chosen to expedite transition into the nonlinear phase of the instability. The shock, upon crossing the perturbation at the interface, instigates the Richtmyer-Meshkov instability. The resulting growth of the mixing region is diagnosed radiographically. Quantitative measurements of the temporal growth of the width of the mixing region are made for six different combinations of amplitude and wavelength, building upon previous results which employed a single amplitude/wavelength combination. Data from both experimental and supporting simulations suggest that the nonlinear growth of the mix width admits a logarithmic time dependence. The results also suggest that, properly normalized, the total mixing width grows in a nearly self-similar fashion, with a weak shape dependence.

NTIS

Wavelengths; Experimentation; Research; Nonlinearity; Stability; Simulation

19990026415 Department of Energy, Washington, DC USA

Wire array z-pinch insights for high x-ray power generation

Sanford, T. W. L., Department of Energy, USA; Mock, R. C., Department of Energy, USA; Marder, B. M., Department of Energy, USA; Dec. 31, 1997; 6p; In English; 12th; High power particle beams

Report No.(s): DE98-003542; SAND-97-3168C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The discovery that the use of very large numbers of wires enables high x-ray power to be generated from wire-array z-pinches represents a breakthrough in load design for large pulsed power generators, and has permitted high temperatures to be generated in radiation cavities on Saturn and Z. In this paper, changes in x-ray emission characteristics as a function of wire number, array mass, and load radius, for 20 mm long aluminum arrays on Saturn that led to these breakthrough hohlraum results, are discussed and compared with a few related emission characteristics of high-wire-number aluminum and tungsten arrays on Z. X-ray measurement comparisons with analytic models and 2-D radiation-magnetohydrodynamic (RMHC) code simulations in the x-y and r-z planes provide confidence in the ability of the models and codes to predict future x-ray performance with very-large-number wire arrays.

NTIS

Wire; X Rays; Zeta Pinch; Electric Generators; Emission; Arrays

19990026416 Department of Energy, Washington, DC USA

Calibration of a direct nuclear activation diagnostic which uses boron nitride to measure energetic deuterium ions

Cooper, G. W., Department of Energy, USA; Chambers, G. D., Department of Energy, USA; Savage, M. E., Department of Energy, USA; Ruiz, C. L., Department of Energy, USA; Schmidlapp, F. A., Department of Energy, USA; Dec. 31, 1998; 18p; In English; 12th; High Temperature plasma diagnostics

Report No.(s): DE98-003541; SAND-98-0660C; CONF-980605; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A direct nuclear activation diagnostic for the measurement of the kinetic energy of deuterium ions in the energy range of 1 to 3 MeV has been successfully developed. This diagnostic is based on the fact that the ratio of two different thick target yields which are generated by the same incident ion species can be a sensitive function of incident ion energy. Targets for this diagnostic are made of (alpha)-boron nitride (BN) and use the two reactions: B-10(d,n)C-11((beta+) and N-14(d,n) O-15((beta+). As long as the BN material matrix remains constant, the ratio of thick target yields depends only on the deuterium ion energy and is independent of ion fluence and detector efficiency. Calibration of the diagnostic was accomplished by irradiating BN targets with deuterium beams of known ion kinetic energy and fluence. The calibrated diagnostic was then fielded to measure the voltage in a Plasma Opening Switch (POS). Electrical measurements of the POS voltage and the voltage inferred from the BN nuclear activation diagnostic were in good agreement.

NTIS

Activation Analysis; Boron Nitrides; Deuterium; Ions; Plasma Diagnostics; Plasmas (Physics)

19990026425 Department of Energy, Washington, DC USA

Improved intra-species collision models for PIC simulations

Jones, M. E., Department of Energy, USA; Lemons, D. S., Department of Energy, USA; Winske, D., Department of Energy, USA; Dec. 31, 1998; 4p; In English; 16th; Numerical simulation of plasma

Report No.(s): DE98-003473; LA-UR-98-397; CONF-980217; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In recent years, the authors have investigated methods to improve the effectiveness of modeling collisional processes in particle-in-cell (PIC) codes. Through the use of generalized collision models, plasma dynamics can be followed both in the regime of nearly collisionless plasmas as well as in the hydrodynamic limit of collisional plasmas. They have developed a collision-field method to treat both the case of collisions between unlike plasma species (inter-species collisions), through the use of a deterministic, grid-based force, and between particles of the same species (intra-species collisions), through the use of a Langevin equation. While the approach used for inter-species collisions is noise-free in that the collision experienced by a particle does not require any random numbers, such random numbers are used for intra-species collisions. This gives rise to a stochastic cooling effect inherent in the Langevin approach. In this paper, the authors concentrate on intra-species collisions and describe how the accuracy of the model can be improved by appropriate corrections to velocity and spatial moments.

NTIS

Plasma Dynamics; Collisional Plasmas; Particle In Cell Technique; Collisions

19990026449 Department of the Navy, Washington, DC USA

Method and Apparatus for Generating High-density Sheet Plasma Mirrors Using a Slotted-tube Cathode Configuration

Mathew, Joseph, Inventor; Sep. 29, 1998; 10p; In English; Supersedes US-Patent-Appl-SN-827517, AD-D018580.

Patent Info.: Filed 28 Mar. 97,; US-Patent-Appl-SN-827,517; US-Patent-5,814,942

Report No.(s): AD-D019168; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A method and apparatus for generating high-density sheet plasma mirrors having a longitudinally slotted cathode, circular in shape, having a inner cavity and a slot of a predetermined width positioned along the length of the cathode. A discharge voltage is applied to the cathode within a vacuum chamber which is backfilled with gasses like oxygen and argon, or mixtures thereof, which in cooperation with a magnetic field, which is higher than the threshold field, causes electrons to flow through the slot in the cathode to an anode, positioned a predetermined distance from the cathode, thereby generating a high-density plasma sheet immersed in the magnetic field of width and thickness proportional to the size of the slot in the cathode.

DTIC

Plasma Generators; Electric Potential; Gas Mixtures; Plasmas (Physics)

19990026532 National Inst. for Fusion Science, Nagoya, Japan

Role of Nonuniform Superthermal Ions for Internal Transport Barriers

Itoh, K., National Inst. for Fusion Science, Japan; Itoh, S.-I., Kyushu Univ., Japan; Yagi, M., Kyushu Univ., Japan; Fukuyama, A., Okayama Univ., Japan; Papers Presented at the 6th H-Mode Workshop; Oct. 1997, pp. 1-4; In English; See also 19990026531; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Influence of inhomogeneity of plasma flow on the magnetic surface, which is driven by the anisotropic hot ions, on the micro turbulence of the low/negative magnetic shear tokamak is investigated. It is found that the poloidal inhomogeneity is effective in suppressing the current-diffusive ballooning mode turbulence which has large nonlinear growth rate. This new mechanism of turbulence suppression provides the model of improved confinement associated with the reversed magnetic shear.

Author

Magnetohydrodynamic Flow; Magnetohydrodynamic Stability; Tokamak Devices; Toroidal Plasmas; Turbulent Flow; Plasma Control

19990026533 National Inst. for Fusion Science, Toki, Japan

Electric Field Bifurcation and Transition in the Core Plasma of CHS

Fujisawa, A., National Inst. for Fusion Science, Japan; Iguchi, H., National Inst. for Fusion Science, Japan; Sanuki, H., National Inst. for Fusion Science, Japan; Itoh, K., National Inst. for Fusion Science, Japan; Itoh, S.-I., Kyushu Univ., Japan; Okamura, S., National Inst. for Fusion Science, Japan; Matsuoka, K., National Inst. for Fusion Science, Japan; Hamada, Y., National Inst. for Fusion Science, Japan; Papers Presented at the 6th H-Mode Workshop; Oct. 1997, pp. 5-8; In English; See also 19990026531; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In the CHS (Compact Helical System) heliotron/torsatron, dynamic phenomena associated with transitions in radial electric field were observed during combined ECH (Electron Cyclotron Heating) and NBI (Neutral Beam Injection) heated plasmas. The observations with high temporal resolution confirmed a nonlinear relation between radial electric field and radial current.

Author (revised)

Heliotrons; Electric Fields; Plasma Heating; Temporal Resolution

19990026534 National Inst. for Fusion Science, Toki, Japan

Formation and Termination of High Ion Temperature Mode in Heliotron/Torsatron Plasmas

Ida, K., National Inst. for Fusion Science, Japan; Kondo, K., Kyoto Univ., Japan; Nagasaki, K., Kyoto Univ., Japan; Zushi, H., Kyoto Univ., Japan; Kurimoto, Y., Kyoto Univ., Japan; Hamada, T., Kyoto Univ., Japan; Sano, F., Kyoto Univ., Japan; Mizuuchi, T., Kyoto Univ., Japan; Okada, H., Kyoto Univ., Japan; Besshou, S., Kyoto Univ., Japan; Funaba, H., Kyoto Univ., Japan; Hidekuma, S., National Inst. for Fusion Science, Japan; Watanabe, K., National Inst. for Fusion Science, Japan; Obiki, T., Kyoto Univ., Japan; Papers Presented at the 6th H-Mode Workshop; Oct. 1997, pp. 9-12; In English; See also 19990026531; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Physics of the formation and termination of High ion temperature mode (high T(sub i) mode) are studied by controlling density profiles and radial electric field. High ion temperature mode is observed for neutral beam heated plasmas in Heliotron/torsatron plasmas (Heliotron-E). This high T(sub i) mode plasma is characterized by a peaked ion temperature profile and is associated with a peaked electron density profile produced by neutral beam fueling with low wall recycling. This high T(sub i) mode is termi-

nated by flattening the electron density caused by either gas puffing or second harmonic ECH (Electron Cyclotron Heating) (core density ”pump-out”).
Author
Ion Temperature; Heliotrons; Plasma Control; Electron Density Profiles; Electric Fields; High Temperature

19990026535 Okayama Univ., Faculty of Engineering, Japan
Transition to an Enhanced Internal Transport Barrier
Fukuyama, A., Okayama Univ., Japan; Takasuka, S., Okayama Univ., Japan; Itoh, S.-I., Kyushu Univ., Japan; Yagi, M., Kyushu Univ., Japan; Itoh, K., National Inst. for Fusion Science, Japan; Papers Presented at the 6th H-Mode Workshop; Oct. 1997, pp. 13-16; In English; See also 19990026531; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The role of E x B rotation shear in the internal transport barrier formation is examined by means of a one-dimensional transport simulation based on the current-diffusive ballooning mode turbulence model. Delayed transition to the enhanced improved transport was reproduced in the medium heating power range. The threshold power is strongly reduced by the effect of rotation shear. Simulation including particle transport was also applied to NBI (Neutral Beam Injection)-heated plasmas and the steepness of density and temperature gradients is discussed.
Author
Ballooning Modes; Magnetohydrodynamic Stability; Plasma Control; Turbulent Flow; Turbulence Models

19990026536 Kyushu Univ., Research Inst. for Applied Mechanics, Kasuga, Japan
Physics of Collapses - Probabilistic Occurrence of ELMs and Crashes
Itoh, S.-I., Kyushu Univ., Japan; Toda, S., Kyushu Univ., Japan; Yagi, M., Kyushu Univ., Japan; Itoh, K., National Inst. for Fusion Science, Japan; Fukuyama, A., Okayama Univ., Japan; Papers Presented at the 6th H-Mode Workshop; Oct. 1997, pp. 17-20; In English; See also 19990026531; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A statistical picture for the collapse phenomenon is proposed. The picture of the crash phenomena, which is based on the turbulence-turbulence transition, is extended to include the statistical variance of observables. The dynamics of the plasma gradient and the turbulence level is studied, with the hysteresis nature in the flux-gradient relation. The probabilistic excitation is predicted. The critical condition is described by the statistical probability.
Author
Collapse; Plasma Turbulence; Magnetohydrodynamic Flow; Magnetohydrodynamic Stability

19990026591 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA
Innovative confinement concepts workshop
Kirkpatrick, R. C., Department of Energy, USA; Dec. 31, 1998; 3p; In English; 2nd; Current Trends in International Fusion Research: Review and Assessment, USA
Report No.(s): DE98-005644; LA-UR-98-6; CONF-9703109-SUMM; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Innovative Confinement Concepts Workshop occurred in California during the week preceding the Second Symposium on Current Trends in International Fusion Research. An informal report was made to the Second Symposium. A summary of the Workshop concluded that some very promising ideas were presented, that innovative concept development is a central element of the restructured US DOE. Fusion Energy Sciences program, and that the Workshop should promote real scientific progress in fusion.
NTIS
Conferences; Fusion (Melting); Thermonuclear Reactions

19990026600 Department of Energy, Washington, DC USA
Plasmas in quasi-static external electric fields
Riley, M. E., Department of Energy, USA; Campbell, R. B., Department of Energy, USA; Jul. 31, 1998; 18p; In English
Report No.(s): DE98-006276; SAND-98-1695; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This work develops some practical approximations needed to simulate a high plasma density volume bounded by walls made of dielectrics or metals which may be either biased or floating in potential. Solving Poisson’s equation in both the high-density bulk and the sheath region poses a difficult computational problem due to the large electron plasma frequency. A common approximation is to assume the electric field is computed in the ambipolar approximation in the bulk and to couple this to a sheath model at the boundaries. Unfortunately, this treatment is not appropriate when some surfaces are biased with respect to others and a net current is present within the plasma. This report develops some ideas on the application of quasi-static external electric fields to

plasmas and the self-consistent treatment of boundary conditions at the surfaces. These constitute a generalization of Ohm's law for a plasma body that entails solving for the internal fields within the plasma and the potential drop and currents through the sheaths surrounding the plasma.
NTIS
Electric Fields; Plasma Density; Electron Plasma

19990026604 Department of Energy, Washington, DC USA
Research technology and graduate education proposal processing ***Final Report***
Hooper, C. F., Department of Energy, USA; Mar. 31, 1998; 100p; In English
Report No.(s): DE98-006193; DOE/SF/21017-T2; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The body of this report is contained in the three attached documents which deal with plasma spectroscopy of laser-produced plasmas. In appendix A the authors consider the Stark broadening effects that occur when bound and continuum states interact during line emission. Appendix B addresses spectroscopic analysis of recent implosions driven by the Omega Laser system, and appendix C presents early studies of plasma induced line shifts from both an experimental and theoretical point of view.
NTIS
Education; Plasmas (Physics); Lasers; Plasma Diagnostics

19990026654 Department of Energy, Office of Energy Research, Washington, DC USA
Overview of design activities for Li/V blankets
Sze, D. K., Department of Energy, USA; Mattas, R. F., Department of Energy, USA; Dec. 31, 1997; 7p; In English; Liquid Metal Blanket Experimental Activities, USA
Report No.(s): DE98-057815; ANL/TD/CP-93894; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Recent fusion power plant design studies in the US have been conducted within the ARIES project. The most recent design of Li/V blankets was conducted as part of the ARIES-RS design. The ARIES-RS fusion power plant design study is based on reversed-shear (RS) physics with a Li/V (lithium breeder and vanadium structure) blanket. The reversed-shear discharge has been documented in many large tokamak experiments. The plasma in the RS mode has a high beta, low current, and low current drive requirement. Therefore, it is an attractive physics regime for a fusion power plant. The blanket system based on a Li/V has high temperature operating capability, good tritium breeding, excellent high heat flux removal capability, long structural life time, low activation, low after heat and good safety characteristics. For these reasons, the ARIES-RS reactor study selected Li/V as the reference blanket. The combination of attractive physics and attractive blanket engineering is expected to result in a superior power plant design.
NTIS
Plant Design; Blankets (Fusion Reactors); Thermonuclear Power Generation

19990026661 Department of Energy, Office of Energy Research, Washington, DC USA
Scrape-off layer turbulence theory and simulations
Xu, X. Q., Department of Energy, USA; Cohen, R. H., Department of Energy, USA; Sep. 04, 1997; 29p; In English; 6th; Plasma Edge Theory in Fusion Devices, USA
Report No.(s): DE98-051156; UCRL-JC-128424; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Significant investigations in the area of scrape-off layer (SOL) turbulence theory and simulations are reviewed. The review begins with description and derivation of the various models investigating specific linear modes as well as a discussion of the region of validity. Special attention is focused on various low-frequency electromagnetic drift-types modes in an x-point divertor geometry, which are generally believed to be relevant under normal operating conditions for current and future large fusion devices. Benchmarks of linear ballooning codes with nonlinear 3D fluid code will be given. The anomalous transport from simulations and mixing length estimates are discussed' and a summary of relevant experimental results as well as empirical values in the transport codes are given. Studies of mechanisms for the L-H transition due to turbulent transport in the SOL and its impact on the the H-mode power threshold are also surveyed.
NTIS
Turbulence; Computerized Simulation; Simulation; Research

19990026664 Department of Energy, Washington, DC USA

Monte Carlo methods in ICF

Zimmerman, G. B., Department of Energy, USA; Jun. 24, 1997; 22p; In English; 13th; Laser Interaction and Related Plasma Phenomena, USA

Report No.(s): DE98-051123; UCRL-JC-126845; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Monte Carlo methods appropriate to simulate the transport of x-rays, neutrons, ion and electrons in Inertial Confinement Fusion targets are described and analyzed. The Implicit Monte Carlo method of x-ray transport handles symmetry within indirect drive ICF hohlraums well, but can be improved 50X in efficiency by angular biasing the x-rays towards the fuel capsule. Accurate simulation of thermonuclear burns nd burn diagnostics involves detailed particle source spectra, charged particle ranges, inflight reaction kinematics, corrections for bulk and thermal Doppler effects and variance reduction to obtain adequate statistics for rare events. It is found that the effects of angular Coulomb scattering must be included in models of charged particle transport through heterogeneous materials.

NTIS

Monte Carlo Method; Simulation; Charged Particles; Correction; Coulomb Collisions; Diagnosis; Electrons; Hohlraums; Inertial Confinement Fusion

19990026665 Department of Energy, Washington, DC USA

Pseudomoment fluid modeling: ion-acoustic landau damping and non- equilibrium temperature

Amendt, P., Department of Energy, USA; May 29, 1997; 23p; In English; 27th; Anomalous Absorption, USA

Report No.(s): DE98-051121; UCRL-JC-127254; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This paper introduces a hierarchy of electron pseudomoment fluid equations that is used to derive electron Landau damping of ion acoustic waves.

NTIS

Fluid Mechanics; Landau Damping; Electron Density (Concentration)

19990026675 Department of Energy, Washington, DC USA

Cylindrical target Li-beam-driven hohlraum experiments

Derzon, M. S., Department of Energy, USA; Aubert, J., Department of Energy, USA; Chandler, G. A., Department of Energy, USA; Jun. 30, 1998; 163p; In English

Report No.(s): DE98-005945; SAND-98-1155; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors performed a series of experiments on the Particle Beam Fusion Accelerator II (PBFA II) in May, 1994, and obtained a brightness temperature of 61 +/- 2 eV for an ion-beam heated hohlraum. The hohlraum was a 4-mm-diameter, right-circular cylinder with a 1.5-mm-thick gold wall, a low-density CH foam fill, and a 1.5- or 3-mm-diameter diagnostic aperture in the top. The nominal parameters of the radially-incident PBFA II Li ion beam were 9 MeV peak energy ((approximately)10 MeV at the gas cell) at the target at a peak power of 2.5 +/- 0.3 TW/cm(sup 2) and a 15 ns pulse width. Azimuthal variations in intensity of a factor of 3, with respect to the mean, were observed. Nonuniformities in thermal x-ray emission across the area of the diagnostic hole were also observed. Time-dependent hole-closure velocities were measured: the time- averaged velocity of (approximately)2 cm/(micro)s is in good agreement with sound speed estimates. Unfolded x-ray spectra and brightness temperatures as a function of time are reported and compared to simulations. Hole closure corrections are discussed with comparisons between XRD and bolometer measurements. Temperature scaling with power on target is also presented.

NTIS

Experimentation; Particle Accelerators; Hohlraums; Particle Beams; Time Dependence; Thermal Emission; Pulse Duration; Brightness Temperature; Cylindrical Bodies

19990026698 Forschungszentrum Juelich G.m.b.H., Juelich, Germany

IEA Implementing Agreement for a Programme of Research and Development on Plasma Wall Interaction in TEXTOR *Progress Report*

1994; 27p; In English

Report No.(s): IATEX-212; No Copyright; Avail: Issuing Activity (Forschungszentrum Juelich G.m.b.H., Juelich, Germany), Hardcopy, Microfiche

The 1994 technical progress report summarizes developments, results, and progress of the Julich Fusion Programme and describes the scientific and technical contributions of the partners of this IEA Implementing Agreement during 1993. The following areas are covered: Operation and Improvements of TEXTOR (Torus Experiment for Technology-Oriented Research), Commissioning of New Systems, Data Processing; ICRH (Ion Cyclotron Resonance Heating) and NBI (Neutral Beam Injection)

Heating, Confinement and Edge Physics Studies; Methods of Particle Control and Energy Exhaust; Stability and Transport in the Plasma Core; Conditioning of Wall Surfaces; Chemical Aspects of Plasma-Wall Interaction; General Properties of the TEXTOR Plasma; Impurity Sources in Tokamaks; Energy and Particle Transport in the Plasma Boundary Layer; Plasma-Wall Interaction: Surface Analysis and Model Experiments; Materials for the Plasma Chamber of Fusion Devices; Wolfram Limiter Experiments in TEXTOR; Pellet Injection Experiments with the ALT-II; Study on Sawtooth and Transport; Edge Plasma Control by RF Limiter; and Design and Fabrication of thick ALT-II Tiles.
CASI
Plasma Control; Plasma Interactions; Tokamak Devices; Research and Development

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SOLID-STATE PHYSICS

Includes superconductivity. For related information, see also 33 Electronics and Electrical Engineering and 36 Lasers and Masers.

19990025212 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China
A Thermoelastic Analysis in a Semi-Infinite Cylindrical Single Crystal During Laser-Heated Pedestal Growth
Wang, Li Hsing, China Junior Coll. of Marine Technology, Taiwan, Province of China; Tsay, Bor Jou, China Junior Coll. of Marine Technology, Taiwan, Province of China; Hon, Min Hsiung, National Cheng Kung Univ., Taiwan, Province of China; Journal of the Chinese Institute of Engineers: Transactions of the Chinese Institute of Engineers, Series A; January 1998; ISSN 0253-3839; Volume 21, No. 1, pp. 101-108; In English
Contract(s)/Grant(s): NSC-87-2216-E-273-002; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The thermal stress produced in a single crystal during fiber growth by temperature variations is analytically obtained and numerically calculated for various Biot numbers and interface shape of the melt and the solid. It is found that maximum stress and dislocation density were produced during the single crystal growth for the growing interface concaving towards the melt with a large Biot number. The temperature distribution far beyond the interface shows little or no difference between the convexed and concaved conditions along the axial and radial direction. However, it is shown that single crystals at the periphery and tip of the concaved-interface have thermal stress (dislocation) 4.8 times higher than the ones with the convexed-interface. The thermal stresses or dislocation density of the spinel calculated from the optical micrograph photographs have the same trends as the derived model.
Author
Laser Heating; Thermal Stresses; Biot Number; Thermoelasticity; Single Crystals; Temperature Distribution; Crystal Growth

19990025216 Northwestern Univ., Center for Quantum Devices, Evanston, IL USA
Growth of InTlSB and InTlP for Long Wavelength Infrared Detector Applications ***Final Report, Jun. 1992 - Dec. 1998***
Razeghi, Manijeh; Dec. 1998; 46p; In English
Contract(s)/Grant(s): N00014-92-J-1951
Report No.(s): AD-A359234; 0650-350-F451; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of this research is to develop room temperature operating long-wavelength infrared (LWIR) photodetectors with novel III-V alloys. For the first time, we have successfully demonstrated the growth of InTlSb, InTlP, and InTlAsSb alloys by low-pressure metalorganic chemical vapor deposition. Other novel alloys such as InAsSb and InSbBi are also investigated. The structural, optical, and electrical properties of these novel materials have been investigated in detail with various ex-situ characterization techniques. For the first time, preliminary LWIR InTlSb photodetectors on GaAs are fabricated with the grown materials and device performance has been characterized. The InTlSb photoconductor showed 11 microns cutoff wavelength at room temperature. The Johnson-noise limited detectivity is estimated to be in the range of 10(exp 6)-10(exp 7) cmHz(1/2)/W. The carrier lifetime is derived from the voltage-dependent responsivity, which is in 0.1-0.6 ns at 300 K. Photoconductivity measurements on InTlP/InP indicate an increase of the cutoff wavelength up to 8 microns with increasing Tl incorporation. Recently, we have observed LWIR photoconductivity up to 15 microns at room temperature by incorporating Tl into InAsSb. These results clearly show the feasibility of using III-V alloys for LWIR photodetector applications as an alternative to HgCdTe detectors.
DTIC
Infrared Detectors; Mercury Cadmium Tellurides; Photoconductivity; Photoconductors; Metalorganic Chemical Vapor Deposition

19990025223 American Inst. of Physics, New York, NY USA

Electronic Properties of Novel Materials - Progress in Molecular Nanostructures. XII International Winterschool

Kuzmany, Hans; Fink, Joerg; Mehring, Michael; Roth, Slegmar; Mar. 1998; 546p; In English

Report No.(s): AD-A359278; AIP-CONFERENCE,PROCEEDING-442; No Copyright; Avail: CASI; A23, Hardcopy; A04, Microfiche

The present book contains the 12th International Winterschool on Electronic Properties of Novel Materials in Kirchberg, Tyrol, Austria. The series of these schools started in 1985. Originally the school was held every second year and was devoted to conducting polymers. After the discovery of high temperature superconductors the periodicity changed to an annual format and the topic alternated between conjugated polymers and superconductors. Since fullerenes are both conjugated compounds and (in some cases) superconductors, it was tempting to choose fullerenes as topic for the Kirchberg schools. The evident extension of this topic is carbon nanotubes and so the title changed from Fullerenes via Fullerene Derivatives and Fullerene Nanostructures to Molecular Nanostructures. This gradual change enables us to keep a fairly large interdisciplinary scientific community together and to stimulate numerous international cooperations. A compilation of the previous Kirchberg Winterschools will be presented in the table at the end of this preface. The term Molecular Nanostructures implies the ”bottom-up” (synthetic) approach, as opposed to the ”top-down” (lithography and etching) techniques in semiconductor technology. As for the physics, we are in a field where solid state physics and molecular physics overlap. This is nicely seen on the example of carbon nanotubes: Their diameter is in the order of a few nanometers and thus perpendicular to their axis nanotubes are molecular (different diameters lead to different electronic structures), along their axis they are extended solids. Most oral contributions to the winterschool were on carbon nanotubes, and there are also three chapters of the proceedings and a large part of the chapter on applications devoted to this topic. The majority of the posters was on fullerenes and fullerides.

DTIC

Fullerenes; Superconductors (Materials); Atomic Structure; Conducting Polymers

19990025486 Timisoara Univ., Romania

Modeling Semiconductor and Quartz Crystal Growth ***Final Report***

Balint, Stafan, Timisoara Univ., Romania; Dec. 1998; 54p; In English

Contract(s)/Grant(s): F61700-89-W-0015

Report No.(s): AD-A358862; EOARD-SPC-98-4001; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report results from a contract tasking West University of Timisoara as follows: The contractor will investigate an improved mathematical model of mass and heat transport by convection and diffusion during semiconductor crystal growth utilizing the Bridgman-Stockbarger and hydrothermal methods.

DTIC

Semiconductors (Materials); Quartz Crystals; Melting; Hydrothermal Crystal Growth

19990025490 North Carolina State Univ., Dept. of Materials Science and Engineering, Raleigh, NC USA

Selected Energy Epitaxial Deposition and Low Energy Electron Microscopy of AlN, GaN and SiC Thin Films ***Quarterly Report, 1 Jul. - 30 Sep. 98; 1 Oct-31 Dec. 1998***

Davis, R. F.; Lamb, H. H.; Tsong, I. S.; Dec. 1998; 23p; In English

Contract(s)/Grant(s): N00014-95-1-0122

Report No.(s): AD-A359150; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In situ real-time low energy electron microscopy of GaN homoepitaxial growth using supersonic jets was conducted. Non-faceted basal-plane GaN(0001) layers were successfully grown when the GaN/NH3 flux ratios exceeded two in the temperature range of 660-710 deg C. Very smooth layers with atomic steps were obtained when growth occurred on regions of the substrate surface previously covered by Ga liquid droplets. This effect is believed to be due to the etching of the GaN substrate surface by the excess Ga, exposing screw dislocations of nucleation and producing an impurity-free surface for growth. Growth of smooth GaN films in the Ga-stable growth regime using an NH3-seeded supersonic molecular beam was also accomplished. A GaN film grown at 700 deg C using 0.6eV NH3 exhibited a RMS roughness of 3.9 nm, as evidenced by atomic force microscopy. Plots of GaN growth rate versus NH3 flow and Ga flux were used to determine the Ga/N ratio needed for non-faceted growth. Increasing the NH3 kinetic energy from 0.25 to 0.41 eV had no effect on growth rate or film morphology for films grown under N-stable conditions. Preliminary results indicate that increasing the NH3 kinetic energy from 0.45 to 0.73 eV did not change the growth rate under Ga-stable conditions, but the surface morphology was improved. Initial cleaning results using a 1.1 eV Kr beam and

Ga flux cleaning at 700 deg C are presented. Future work will include testing of a supersonic N atom source and SEED of AlN on 6H-SiC.
DTIC
Thin Films; Nitrogen; Electron Microscopy; Electron Energy; Crystal Growth; Kinetic Energy; Epitaxy

19990025492 North Carolina State Univ., Dept. of Materials Science and Engineering, Raleigh, NC USA
Research Related to the Development, Fabrication and Characterization of UV Detectors and Cold Cathode Devices
Annual Report, 1 Jan. - 31 Dec. 1998
Davis, R. F.; Carlson, E.; Gehrke, T.; Hanser, A. D.; Hartlieb, P.; Dec. 1998; 25p; In English
Contract(s)/Grant(s): N00014-96-1-0765
Report No.(s): AD-A359160; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Pendeo-epitaxial growth of GaN films has been investigated as a function of growth temperature on etched, elongated GaN seed columns grown on AlN/6H-SiC (0001) substrates via metalorganic vapor phase epitaxy (MOVPE). Silicon nitride mask layers atop the GaN seed columns forced growth from the sidewalls of the columns. Higher growth temperatures resulted in improved coalescence due to greater lateral-to-vertical growth ratios. Thin films of AlN and GaN were also deposited via conventional approaches on alpha(6H)-SiC(0001) wafers using H2 and N2 diluents. A computational fluid dynamic model of the deposition process was used to analyze the film growth conditions for both diluents. Low temperature (12 K) photoluminescence of the GaN films grown in N2 had peak intensities and full widths at half maximum of 7 meV which were equal to or better than those films grown in H2. Cross-sectional and plan view transmission electron microscopy of GaN films grown in both diluents showed similar microstructures with a typical dislocation density of 10(exp 9)/cm2. Hall measurements of n-type (Si doped) GaN grown in N2 revealed Hall mobilities equivalent to those films grown in H2. Acceptor-type behavior of Mg-doped GaN grown in N2 was repeatedly obtained without post-growth annealing. Secondary ion mass spectrometry revealed equivalent levels of H in Mg-doped GaN films grown in both diluents. The electrical properties of Ni/Au contacts on p-type, Mg-doped GaN films have been characterized using current-voltage measurements. Prior to the metallization, films with net ionized impurity concentrations of approximately 7x10(exp 17)/cm3 and 2x10(exp 17)/cm3 were heated to 990 deg C and 800 deg C, respectively, and subsequently exposed to a 300 W atomic nitrogen plasma for 10 minutes. The contacts treated at 990 deg C yielded the lowest specific contact resistivity, which was 50 +/- 7 omega.cm2.
DTIC
Epitaxy; Thin Films; Computational Fluid Dynamics

19990025786 Department of Energy, Office of Energy Research, Washington, DC USA
Radiation-Induced Phase Transformations in Ilmenite-Group Minerals
Mitchell, J., Department of Energy, USA; Dec. 31, 1997; 12p; In English; New directions in transmission electron microscopy and nan0-characterization of materials
Report No.(s): DE97-008570; LA-UR-97-2192; CONF-9703119; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Transmission electron microscopy (TEM) is a powerful tool for characterizing and understanding radiation-induced structural changes in materials. We have irradiated single crystals of ilmenite FeTiO(sub 3) and geikielite MgTiO(sub 3) using ions and electrons to better understand the response of complex oxides to radiation. Ion irradiation experiments of bulk single crystals at 100 K show that ilmenite amorphized at doses of less than 1 x 10(exp 15) Ar(2+)/sq cm and at a damage level in the peak damage region of 1 displacement per atom (dpa). Transmission electron microscopy and electron diffraction of a cross-sectioned portion of this crystal confirmed the formation of a 150 am thick amorphous layer. Geikielite proved to be more radiation resistant, requiring a flux of 2 x 10(exp 15) Xe(2+)/sq cm to induce amorphization at 100 K. This material did not amorphize at 470 K, despite a dose of 2.5 x 10(exp 16) Xe(2+)/sq cm and a damage level as high as 25 dpa. Low temperature irradiations of electron- transparent crystals with 1 MeV Kr(+) also show that ilmenite amorphized after a damage level of 2.25 dpa at 175 K.Similar experiments on geikielite show that the microstructure is partially amorphous and partially crystalline after 10 dpa at 150 K. Concurrent ion and electron irradiation of both materials with 1 MeV Kr(+) and 0.9 MeV electrons produced dislocation loops in both materials, but no amorphous regions were formed. Differences in the radiation response of these isostructural oxides suggests that in systems with Mg-Fe solid solution, the Mg-rich compositions may be more resistant to structural changes.
NTIS
Radiation Tolerance; Phase Transformations; Radiation Dosage

19990025876 Department of Energy, Office of Energy Research, Washington, DC USA

Bandgap renormalization: GaAs/AlGaAs quantum wells

Jones, E. D., Department of Energy, USA; Blount, M., Department of Energy, USA; Chow, W., Department of Energy, USA; Hou, H., Department of Energy, USA; Simmons, J. A., Department of Energy, USA; Jan. 31, 1998; 9p; In English; BIOS 1998: Biomedical Optics

Report No.(s): DE98-002592; SAND-97-1980C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Bandgap energy renormalization by many-body interactions has been studied in a series of n-type 8-nm-wide GaAs/AlGaAs single quantum wells using magneto luminescence spectroscopy at 1.4 K and for magnetic fields up to 30 T. The 2D-carrier densities varied between 1 and 12 x 10(11) cm(-2). At the maximum 2D-carrier density, the bandgap energy difference between the doped and undoped samples was about 34 meV.

NTIS

Energy Gaps (Solid State); Gallium Arsenides; Aluminum Gallium Arsenides; Quantum Wells; Quantum Electronics

19990025896 Georgia Inst. of Tech., Atlanta, GA USA

Preparation and Dielectric Measurements of the Rare Earth Green Phases R2BaCuO(5-x) (R = Y, Sm, Gd, Dy, Ho, Er, Yb)

Gonzalez-Titman, Carlos, Georgia Inst. of Tech., USA; May 1994; 165p; In English

Contract(s)/Grant(s): NGT-70356; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

It has been demonstrated that R2BaCuO(5-x) (R = Y, Sm, Gd, Dy, Ho, Er, Yb) does not undergo significant densification unless the sintering temperatures are near the incongruent melting point or the sintering times are long. Good quality powders of Y2BaCuO(5-x) have been synthesized by using oxide raw materials or precursors such as acetates and nitrates. The acetates- and the nitrates-derived yttrium green phase resulted in finer particle sizes, acceptable dielectric properties and lower melting temperatures than those processed via oxide raw materials. The hot pressing technique has been employed to produce a dense R2BaCuO(5-x) (R=Y,Gd) substrate with satisfactory dielectric properties. Reactivity to reducing conditions, i.e. graphite die, limited the optimization of the properties. A high sensitivity to the annealing atmosphere has been demonstrated in Y2BaCuO,.,,. Oxygen treatment at 950 OC has been shown to improve the dielectric properties while treatment in nitrogen, at the same temperature, degraded desirable properties. A high sensitivity to the annealing atmosphere has been demonstrated in Y2BaCuO(5-x). Oxygen treatment at 950 C has been shown to improve the dielectric properties while treatment in nitrogen, at the same temperature, degraded desirable properties. The dielectric constants of the rare earth green phases R2BaCuO(5-x) were found to be low. Relaxation peaks were detected at low temperatures (T less than 150 K) and at high temperatures (150 less than T greater than 420 K). The dielectric losses and conductivities at 77 K were measured to be in the range of 10(exp -4) and 10(exp -12) (Omega-cm)(exp -1), respectively. Many parameters were found to exhibit dependencies on the rare earth cation sizes.

Author

Dielectric Properties; Dielectrics; Rare Earth Compounds; Phases

19990025916 Georgia Inst. of Tech., School of Electrical and Computer Engineering, Atlanta, GA USA

Growth and Fabrication of GaN-Based Heterojunction Bipolar Transistors ***Annual Report, 1 Jan. - 31 Dec. 1998***

Brown, April S.; Jan. 25, 1999; 8p; In English

Contract(s)/Grant(s): N00014-98-1-0209

Report No.(s): AD-A359392; TR-1; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

GaN HBTs are promising for microwave power applications but face numerous technology barriers. In this project, we are addressing the enhancement of the hole concentration in p-type GaN by piezoelectric effects and/or the use of superlattices. We are currently assessing the activity of Mg-doped GaN on sapphire and lithium gallate as grown by MBE. In addition, we are modeling these effects to optimize the hole concentration in realistic HBT structures.

DTIC

Gallium Nitrides; Bipolar Transistors; Doped Crystals; Heterojunction Devices; Fabrication; Molecular Beam Epitaxy

19990025966 Oklahoma State Univ., Dept. of Physics, Stillwater, OK USA

MBE Growth and Characterization of GaN/AlN Structures Under Hydrostatic Pressure ***Final Report, 1 Jun. 1993 - 31 May 1997***

Hauenstein, R. J.; Jul. 30, 1997; 7p; In English

Contract(s)/Grant(s): F49620-93-1-0389; AF Proj. 3484

Report No.(s): AD-A359207; AFRL-SR-BL-TR-99-0005; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We present the results of a series of studies on the optical properties of GaN and AlGaN/GaN heterostructures using a variety of spectroscopic techniques. Strain effects were found to have a strong influence in determining the energies of excitonic transitions. The observations of spectral features associated with the transitions involving the ground and excited exciton states make it possible to directly estimate binding energy for the excitons in GaN. Optical pumping experiments were performed on AlGaN/GaN separate confinement heterostructures (SCH) grown on sapphire by MBE and SiC by MOCVD. The threshold pumping powers were found to be an order of magnitude lower than that for regular GaN epilayers. Nonlinear four-wave-mixing experiments were carried out in both femtosecond and picosecond regimes to study the intensity and time response of scattering efficiency, as well as the pump-induced nonlinear refractive index change.
DTIC
Four-Wave Mixing; Ground State; Hydrostatic Pressure; Metalorganic Chemical Vapor Deposition; Molecular Beam Epitaxy; Spectra; Spectroscopy

19990026047 Army Research Lab., Sensors Directorate, Adelphi, MD USA
MBE Growth and Characterization of HgCdTe Heterostructures for Multi-Spectral Infrared Focal Plane Arrays
Shih, H. D., Texas Instruments, Inc., USA; Bevan, M. J., Texas Instruments, Inc., USA; Dodge, J. A., Texas Instruments, Inc., USA; Seymour, B., Texas Instruments, Inc., USA; Schaake, H. F., Texas Instruments, Inc., USA; Dhar, N., Army Research Lab., USA; Boyd, P., Army Research Lab., USA; Jan. 1998; 5p; In English; Prepared in cooperation with Texas Instruments, Inc. Dallas, TX
Report No.(s): AD-A358573; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

MBE growth of HgCdTe affords excellent control of film layer thicknesses which are required to achieve a stacked simultaneously integrating two-color focal plane array. For the near term, a hybrid design using back-to-back ion implanted diodes in MBE grown material is being pursued. This structure could have as few as two layers, although three layers are preferred to insure full spectral separation and widen manufacturing tolerance windows. The structure also affords the ability to quantify progress in the growth of materials for monolithic approaches, which are in the more distant future. Progress in the growth of MBE films meeting the needs of this structure is presented.
DTIC
Focal Plane Devices; Infrared Radiation; Mercury Cadmium Tellurides; Molecular Beam Epitaxy

19990026058 Department of Energy, Office of Energy Research, Washington, DC USA
Electronic excitations and correlation effects in metals
Eguiluz, A. G., Department of Energy, USA; Schoene, W. D., Department of Energy, USA; Jul. 31, 1997; 40p; In English
Report No.(s): DE97-008547; CONF-9706178-1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Theoretical descriptions of the spectrum of electronic excitations in real metals have not yet reached a fully predictive, first-principles stage. In this paper the authors begin by presenting brief highlights of recent progress made in the evaluation of dynamical electronic response in metals. A comparison between calculated and measured spectra--they use the loss spectra of Al and Cs as test cases--leads them to the conclusion that, even in weakly-correlated metals, correlation effects beyond mean-field theory play an important role. Furthermore, the effects of the underlying band structure turn out to be significant. Calculations which incorporate the effects of both dynamical correlations and band structure from first principles are not yet available. As a first step towards such goal, they outline a numerical algorithm for the self- consistent solution of the Dyson equation for the one-particle Green's function. The self-energy is evaluated within the shielded-interaction approximation of Baym and Kadanoff. Their method, which is fully conserving, is a finite-temperature scheme which determines the Green's function and the self- energy at the Matsubara frequencies on the imaginary axis. The analytical continuation to real frequencies is performed via Pade' approximant. They present results for the homogeneous electron gas which exemplify the importance of many-body self-consistency.
NTIS
Excitation; Metals; Electron Gas; Green"S FUNCTIONS; Many Body Problem

19990026061 Department of Energy, Office of Energy Research, Washington, DC USA
Spatial modulation of low-frequency spin fluctuations in hole-doped La2CuO4
Yamada, K., Department of Energy, USA; Lee, C. H., Department of Energy, USA; Wada, J., Department of Energy, USA; Kurahashi, K., Department of Energy, USA; Kimura, H., Department of Energy, USA; Dec. 31, 1996; 13p; In English
Report No.(s): DE97-008887; BNL-64555; CONF-961224; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Systematic neutron scattering measurements have been performed on the SR-doped La(2-x)SR(x) CuO4 to study the doping dependence of spatially modulated dynamical spin correlations or so-called incommensurate spin fluctuations. The modulated

spin correlations appears beyond x approx. 0.05 which is close to the lower boundary of the superconducting phase. First evidence was observed for the linear relation between the degree of spatial modulation or the incommensurability delta(x) and the maximum Tc at x. We present a universal curve for delta(x) by adding data from other La2CuO4 systems such as oxygen-doped superconductors, oxygen-reduced or Zn-substituted non-superconductors and La(1.6-x)Nd(0.4)SR(x)CuO4.
NTIS
Lanthanum Compounds; Copper Oxides; Modulation; Doped Crystals; Additives

19990026062 Department of Energy, Office of Energy Research, Washington, DC USA
Low-frequency spin fluctuations in the superconducting La(2-x)SR(x)CuO4
Yamada, K., Department of Energy, USA; Lee, C. H., Department of Energy, USA; Endoh, Y., Department of Energy, USA; Shirane, G., Department of Energy, USA; Birgeneau, R. J., Department of Energy, USA; Feb. 28, 1997; 6p; In English
Report No.(s): DE97-008937; BNL-64556; CONF-970235; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Recent progress in low-energy neutron scattering study on the spatially modulated or so-called incommensurate spin fluctuations is reviewed. Well-defined incommensurate spin fluctuations are observed beyond x approx. equal to 0.05 and up to the highest SR-concentration x approx. 0.25 in the present study. The incommensurability delta(x) is saturated at around 1/8 in the overdoped region and linearly scaled with the upper limit of Tc(x) between the underdoped and optimally doped region. A characteristic energy E* below which the dynamical magnetic susceptibility dramatically diminishes in the superconducting state can be determined to be around 7 meV in the energy spectrum of the spin fluctuations for x = 0.15 and x = 0.18 crystals. The disorder effect induces a low-frequency component of the incommensurate spin fluctuations below E*.
NTIS
Doped Crystals; Copper Oxides; Spatial Distribution; Modulation; Spin; Lanthanum Compounds; Strontium Compounds; Energy Spectra

19990026207 Department of Energy, Office of Energy Research, Washington, DC USA
Highly efficient near-threshold spin-polarized electron emission from strained superlattices
Subashiev, A. V., Department of Energy, USA; Mamaev, Y. A., Department of Energy, USA; Yashin, Y. P., Department of Energy, USA; Aug. 31, 1998; 6p; In English; 24th; Physics of Semiconductors, Unknown
Report No.(s): DE98-059270; SLAC-PUB-7922; CONF-980829; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Electron photoemission from strained GaAs/Al(x)In(y)Ga(1-(x-y))As superlattice with near zero offset at a conduction band was investigated. Low value of the offset was provided by appropriate composition in the strained AlInGaAs layers. After three activations, the Quantum Yield (Y) at the polarization peak was about 0.6%, which corresponds to the best values whenever measured. In the samples with lower Y (0.21%) the polarization of up to 86% was measured, which evidence the validity of the structures for the application in the polarized electron sources.
NTIS
Superlattices; Photoelectric Emission

19990026213 Department of Energy, Office of Energy Research, Washington, DC USA
Inelastic neutron studies of the low energy phonon excitations in the RENi2B2C superconductors (RE=Lu,Y,Ho,Er)
Bullock, M., Department of Energy, USA; Stassis, C., Department of Energy, USA; Zarestky, J., Department of Energy, USA; Goldman, A., Department of Energy, USA; Canfield, P., Department of Energy, USA; Aug. 31, 1997; 11p; In English; Neutron scattering
Report No.(s): DE97-008943; BNL-64633; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

We studied the low-energy phonon excitations for wavevectors close to the Fermi surface nesting vector (xi)(sub m) = 0.55 a vector. We find that above T(sub c) the frequencies of the (Delta)(sub 4) ((zeta)00) lowest-lying optical and acoustic phonon modes decrease with decreasing temperature, for (xi) close to (xi)(sub m), and there is a shift of intensity from the upper to the lower mode, an effect characteristic of coupled modes. From approximately 120 K down to temperatures in the vicinity of T(sub c), only a single unresolved peak is observed. Below Tc the phonon spectra of the Y and Lu compounds change dramatically: it consists of a sharp peak at approximately 4.5 meV with a weak shoulder at the higher energy side. No such sharp peak was observed below T(sub c) in the Ho and Er compounds.
NTIS
Neutrons; Phonons; Superconductors (Materials); Molecular Excitation

19990026238 Department of Energy, Office of Energy Research, Washington, DC USA

Photorefractivity in polymer-stabilized nematic liquid crystals

Wiederrecht, G. P., Department of Energy, USA; Wasielewski, M. R., Department of Energy, USA; Dec. 31, 1998; 8p; In English; 43rd; Optical science, engineering, and instrumentation

Report No.(s): DE98-057787; ANL/CHM/CP-96854; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Polymer-stabilized liquid crystals, consisting of low concentrations of a polymeric electron acceptor, are shown to exhibit significantly enhanced photorefractive properties. The charge generation and transport properties of these composite systems are strongly modified from nematic liquid crystals doped with electron donors and acceptors. The new composites are produced by polymerizing a small quantity of a 1,4:5,8-naphthalenediimide electron acceptor functionalized with an acrylate group in an aligned nematic liquid crystal. Photopolymerization creates an anisotropic gel-like medium in which the liquid crystal is free to reorient in the presence of a space charge field, while maintaining charge trapping sites in the polymerized regions of the material. The presence of these trapping sites results in the observation of longer lived, higher resolution holographic gratings in the polymer-stabilized liquid crystals than observed in nematic liquid crystals alone. These gratings display Bragg regime diffraction. Asymmetric beam coupling, photo-conductivity, and four-wave mixing experiments are performed to characterize the photophysics of these novel materials.

NTIS

Photorefractivity; Polymerization; Liquid Crystals; Electron Transfer

19990026239 Department of Energy, Office of Energy Research, Washington, DC USA

Charge transfer reactions in nematic liquid crystals

Wiederrecht, G. P., Department of Energy, USA; Wasielewski, M. R., Department of Energy, USA; Galili, T., Department of Energy, USA; Levanon, H., Department of Energy, USA; Dec. 31, 1998; 10p; In English; 43rd; Optical science, engineering, and instrumentation

Report No.(s): DE98-057786; ANL/CHM/CP-96855; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Ultrafast transient absorption studies of intramolecular photoinduced charge separation and thermal charge recombination were carried out on a molecule consisting of a 4-(N-pyrrolidino) naphthalene-1, 8-imide donor (PNI) covalently attached to a pyromellitimide acceptor (PI) dissolved in the liquid crystal 4(prime)-(n-pentyl)-4-cyanobiphenyl (5CB). The temperature dependencies of the charge separation and recombination rates were obtained at temperatures above the nematic-isotropic phase transition of 5CB, where ordered microdomains exist and scattering of visible light by these domains is absent. The authors show that excited state charge separation is dominated by molecular reorientation of 5CB perpendicular to the director within the liquid crystal microdomains. They also show that charge recombination is adiabatic and is controlled by the comparatively slow collective reorientation of the liquid crystal microdomains relative to the orientation of PNI(sup +)-PI(sup -)). They also report the results of time resolved electron paramagnetic resonance (TREPR) studies of photoinduced charge separation in a series of supramolecular compounds dissolved in oriented liquid crystal solvents. These studies permit the determination of the radical pair energy levels as the solvent reorganization energy increases from the low temperature crystalline phase, through the soft glass phase, to the nematic phase of the liquid crystal.

NTIS

Electron Transfer; Liquid Crystals; Charge Transfer; Polarization (Charge Separation)

19990026262 Department of Energy, Office of Energy Research, Washington, DC USA

Photoelectron Spectroscopy of YbInCu4: Direct Testing of Correlated Electron Models

Joyce, J. J., Department of Energy, USA; Arko, A. J., Department of Energy, USA; Sarrao, J. L., Department of Energy, USA; Fisk, Z., Department of Energy, USA; Oct. 31, 1997; 5p; In English; Synchrotron radiation center

Report No.(s): DE98-003006; LA-UR-97-4211; CONF-9710154; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The electronic properties of single crystal YbInCu4 have been investigated by means of high resolution photoelectron spectroscopy. A first order, isostructural phase transition for YbInCu4 at T(sub v) = 42 K leads to changes in the Kondo temperature of more than an order of magnitude (27 K vs. 400 K). This phase transition and accompanying Kondo temperature change provide the most direct test of the single impurity model (SIM) to date. Particle hole symmetry allows the SIM to be used for Yb compounds as well as Ce heavy fermions with the great advantage that the predicted Kondo resonance is found on the occupied side of the spectral weight function for Yb materials and is thus directly observable in photoemission. The photoemission results are incongruous with the single impurity model predictions for temperature dependence, binding energy and 4f occupancy, encouraging

a reevaluation of the single impurity model. The experiments were conducted using the PGM undulator and 4 meter NIM beamlines at SRC. The spectra were taken at photon energies of 40 eV and 90 eV and the combined energy resolution of the analyzer and monochromator was 45-85 meV.
NTIS
Photoelectron Spectroscopy; Ytterbium Compounds; Indium Compounds; Copper Compounds; Intermetallics; Atomic Structure

19990026269 Department of Energy, Office of Energy Research, Washington, DC USA
Modulated spin and charge densities in cuprate superconductors
Tranquada, J. M., Department of Energy, USA; Aug. 31, 1997; 8p; In English; Neutron scattering
Report No.(s): DE97-008944; BNL-64632; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Neutron scattering experiments have played a crucial role in characterizing the spin and charge correlations in copper-oxide superconductors. While the data are often interpreted with respect to specific theories of the cuprates, an attempt is made here to distinguish those facts that can be extracted empirically, and the connections that can be made with minimal assumptions.
NTIS
Neutron Scattering; Superconductors (Materials); Density (Number/Volume); Spin; Electric Charge; Correlation

19990026281 Department of Energy, Office of Energy Research, Washington, DC USA
Unconstrained energy functionals for electronic structure calculations
Pfrommer, B. G., Department of Energy, USA; Demmel, J., Department of Energy, USA; Simon, H., Department of Energy, USA; Apr. 30, 1998; 25p; In English
Report No.(s): DE98-059373; LBNL-41735; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The performance of conjugate gradient schemes for minimizing unconstrained energy functionals in the context of electronic structure calculations is studied. The unconstrained functionals allow a straightforward application of conjugate gradients by removing the explicit orthonormality constraints on the quantum-mechanical wave functions. However, the removal of the constraints can lead to slow convergence, in particular when preconditioning is used. The convergence properties of two previously suggested energy functionals are analyzed, and a new functional is proposed, which unifies some of the advantages of the other functionals. A numerical example confirms the analysis.
NTIS
Atomic Structure; Solids; Conjugate Gradient Method

19990026452 Department of the Navy, Washington, DC USA
Radiation-Hardening of SOI by Ion Implantation into the Buried Oxide Layer
Hughes, Harold, Inventor; McMarr, Patrick, Inventor; Aug. 18, 1998; 3p; In English; Supersedes US-Patent-Appl-SN-655780
Patent Info.: Filed 31 May 96,; US-Patent-Appl-SN-655,780; US-Patent-5,795,813
Report No.(s): AD-D019172; No Copyright; Avail: US Patent and Trademark Office, Microfiche
The radiation hardness of a silicon-on-insulator structure is improved by implanting dopant ions such as Si into the buried oxide layer. The dopant ions are implanted in the buried oxide layer, near, but not at the active Si layer/buried oxide layer interface. This implantation creates electron traps/recombination centers in the buried oxide layer.
DTIC
Layers; Ion Implantation; Radiation Hardening; Oxides; SOI (Semiconductors)

19990026500 Department of the Navy, Washington, DC USA
Quantitative Mobility Spectrum Analysis for Magnetic Field Dependent Hall and Resistivity Data
Meyer, Jerry R., Inventor; Hoffman, Craig A., Inventor; Bartoli, Filbert J., Inventor; Antoszewski, Jaroslaw, Inventor; Faraone, Lorenzo, Inventor; Aug. 04, 1998; 12p; In English; Supersedes US-Patent-Appl-SN-539182, AD-D017792.
Patent Info.: Filed 4 Oct. 95,; US-Patent-5,789,931; US-Patent-Appl-SN-539,182
Report No.(s): AD-D019238; No Copyright; Avail: US Patent and Trademark Office, Microfiche
A method and apparatus for producing the conductivity-mobility spectrum of an isotropic semiconductor material, and hence infer the mobility and concentration of carriers in the material. Hall voltage and material conductivity are measured at a plurality of magnetic field strengths, values of the spectrum estimated for each field strength, and the estimates numerically iterated to produce convergent values for the spectrum. In one embodiment, interim selected values of the spectrum are prevented from going negative, which increases the precision of the ultimate convergent values. In another embodiment, the iteration equations employ

damping factors to prevent over-correction from one iteration to the next, thus preventing convergent instabilities. The preferred iteration is the Gauss-Seidel recursion.
DTIC
Hall Effect; Electric Potential; Electrical Resistivity; Field Strength; Magnetic Flux

19990026590 Department of Energy, Washington, DC USA
Crystal chemistry of hydroxyl and water in silicate minerals ***Final Report***
Smyth, J. R., Department of Energy, USA; Dec. 31, 1998; 2p; In English
Report No.(s): DE98-005684; DOE/ER/14233-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
This was a project to investigate the crystal chemistry of OH and H2O substitution in silicate minerals by use of X-ray and neutron diffraction methods combined with IR spectroscopy and to interpret and generalize the results using an electrostatic model for these mineral structures. Using these data together with published H position data electrostatic parameters for H sites were calculated from a simple electrostatic model. The data were then used to refine the model for incorporation of H into the wadsleyite structure. This has led to recent work on the synthesis and characterization of hydrous wadsleyites.
NTIS
Crystal Structure; Minerals; Hydroxyl Compounds; Water; Silicates; Physical Chemistry

19990026619 Joint Publications Research Service, Arlington, VA USA
JPRS Report Science & Technology USSR: Physics & Mathematics
Sep. 16, 1991; 43p; In English
Report No.(s): AD-A359863; JPRS-UPM-91-006; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This document contains articles translated from foreign periodicals into English that concern physics and mathematics in the USSR. Some topics discussed in the articles include: acoustics, crystals, laser glasses, semiconductors, lasers, molecular physics, nuclear physics, optics, spectroscopy, plasma physics, and superconductivity.
DTIC
Physics; Mathematics; Acoustics; Technologies

19990026620 Joint Publications Research Service, Arlington, VA USA
JPRS Report, Science & Technology USSR: Physics & Mathematics
Dec. 03, 1991; 44p; In English
Report No.(s): AD-A359868; JPRS-UPM-91-007; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This document contains translations of articles from various foreign periodicals into English concerning physics and mathematics in the USSR. Some topics discussed are: acoustics, crystals, laser glasses, semiconductors, laser, magnetohydrodynamics, nuclear physics, optics, spectroscopy, plasma physics, superconductivity, thermodynamics, theoretical physics.
DTIC
Physics; Mathematics; Magnetohydrodynamics; Acoustics

19990026721 Advanced Fuel Research, Inc., East Hartford, CT USA
Epitaxial Growth of High Quality SiC of Pulsed Laser Deposition ***Final Report, 21 Jul. 1994 - 21 Jan. 1995***
Hamblen, David G.; Fenner, David B.; Rosenthal, Peter A.; Cosgrove, Joseph; Kung, Pang-Jen; Feb. 20, 1995; 45p; In English
Contract(s)/Grant(s): F33615-94-C-5417
Report No.(s): AD-A360082; 526033; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The goal of this research program is to develop Pulsed Laser Deposition (PLD) as a method for depositing device quality, single crystal silicon carbide (SiC) thin films. Phase I has demonstrated the ability to deposit single crystal 3C-SiC thin films on Si (100) and 6H-SiC (0001) substrates. An existing PLD facility was improved for SiC depositions. Prior to PLD, all substrates were prepared using a novel spin etch technique. Numerous experiments explored the effect of substrate temperature and laser fluence on the resulting SiC films. Composition of the films was measured by Rutherford backscattering spectrometry and Scanning Auger Microprobe. The films were slightly carbon-rich although the excess carbon component was attributed to background contaminants in our vacuum system. Optical analyses included Fourier Transform infrared (FT-IR) spectroscopy. Epitaxy of the 3C-SiC films was confirmed by x-ray diffraction, transmission electron microscopy, and electron diffraction. Epitaxial SiC films were grown on Si (100) at temperatures as low as 930 deg C, although the crystallinity of the films improved with increasing

temperature. The best films result at laser fluences of 1.5 - 2 J/sq cm. Single crystal films were obtained on 6H-SiC (0001) and vicinal 6H-SiC (0001) oriented 3.5 towards 1120 at 1200 deg C.
DTIC
Pulsed Lasers; Silicon Carbides; Epitaxy

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THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; theoretical physics; and Bose and Fermi statistics. For related information see also 25 Inorganic and Physical Chemistry and 34 Fluid Mechanics and Heat Transfer.

19990025329 California Univ., Dept. of Mechanical Engineering, Davis, CA USA
Measurements of the Heat Transfer Coefficient Distribution on Flat and Ribbed Surfaces with Interrupted Heating Using Thermochromic Liquid Crystals
Wolf, Jason D., California Univ., USA; Jan. 1998; 128p; In English
Report No.(s): AD-A359068; AFIT-FY99-42; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Measurements of the heat transfer coefficient distribution on flat and ribbed surfaces with interrupted heating are presented. One application of this type of thermal boundary condition is the cooling of surface mounted modules in electronic packaging. Heating occurs at the modules, with no heating between the modules. The heat transfer measurements in the present study are made using the heated-coating method with a thermochromic liquid crystal (TLC). The ”coating” is vacuum-deposited gold on a plastic sheet, which is mounted on a Styrofoam surface. The gold film is electrically heated to produce the surface heat flux. The surface temperature is measured by capturing color images of the TLC, using the hue technique. These surface temperature plots are transformed into heat transfer coefficient distributions on the surface of the models. Interrupted heating on the flat surface is obtained by heating strips perpendicular to the freestream flow, with insulated spaces between the strips. The ribbed surface is heated on the top of the ribs only, with insulated unheated cavities in-between. The results show that, as expected, the local heat transfer coefficient is higher on the heated strips of the flat surface interrupted heating case, than would be present at the same locations with a uniform heat flux. The interruption of the thermal boundary layer at each unheated section allows it to ”reset”, thereby causing the higher heat transfer on the following heated section. The ribbed model shows a slight increase in heat transfer on the ribs above that of the flat plate interrupted heating model. The cavities appear to introduce mixing that causes this change. The increase in h due to the ribs is small, however, when compared to the effect of the interrupted heating.
DTIC
Heat Transfer Coefficients; Surface Temperature; Flat Surfaces; Ribs (Supports); Liquid Crystals; Heating; Flat Plates; Thermochromatic Materials

19990026103 Dayton Univ. Research Inst., Research Inst., OH USA
Combustion and Heat Transfer; Volume 1 - Advanced Jet Fuels Data Studies ***Final Report, 8 Jun. 1992 - 31 Dec. 1997***
Zabarnick, S.; Ballal, D. R.; Binns, K. E.; Dieterle, G. L.; Ervin, J. S.; Apr. 1998; 225p; In English
Contract(s)/Grant(s): F33615-92-C-2207; AF Proj. 3048
Report No.(s): AD-A359360; UDR-TR-1998-00035-VOL-1; AFRL-PR-WP-TR-1998-2067; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

This report highlights studies performed in support of the development of advanced jet fuels, including JP-8+100, JP-900, and endothermic fuels. For the development of JP-8+100 fuel, we have tested hundreds of additives in both small and large scale test devices. We formulated combinations of the best additives (detergent/dispersant, hindered phenol antioxidant, and metal deactivator) and demonstrated their efficacy in reducing deposition under realistic aircraft conditions in large-scale simulator rigs. We optimized the concentrations of these additives for maximum effectiveness and minimum cost. We performed extensive studies of the compatibility of these fuel additives with current and future aircraft fuel system materials. We determined that the current best additives show no negative effects on both metallic and non-metallic fuel system materials. We also performed extensive studies on the fundamental processes of fuel oxidation, deposition, and pyrolysis. We made progress in support of development of future fuels such as JP-900 and endothermic fuels. Data set summaries of the much of the data obtained during the contract period are contained in the accompanying volume entitled, ”Combustion and Heat Transfer; Volume 2 - Advanced Jet Fuels Data Sets.”
DTIC
Combustion; Jet Engine Fuels; Endothermic Reactions; Aircraft Fuel Systems; Heat of Combustion

19990026104 Dayton Univ. Research Inst., Research Inst., OH USA
Combustion and Heat Transfer; Volume 2 - Advanced Jet Fuels Data Sets ***Final Report, 8 Jun. 1992 - 31 Dec. 1997***
Zabarnick, S.; Ballal, D. R.; Binns, K. E.; Dieterle, G. L.; Ervin, J. S.; Apr. 1998; 137p; In English
Contract(s)/Grant(s): F33615-92-C-2207; AF Proj. 3048
Report No.(s): AD-A359361; UDR-TR-1998-00036-VOL-2; AFRL-PR-WP-TR-1998-2068; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This report consists of data set summaries of tests performed in support of the development of advanced jet fuels, including JP-8+100, JP-900, and endothermic fuels. This includes data sets for the quartz crystal microbalance (QCM), the isothermal corrosion oxidation test (ICOT), the Phoenix rig, the fuel/materials compatibility studies, the extended duration thermal stability test (EDTST), and the advanced reduced scale fuel system simulator (ARSFSS). These data sets, and/or more complete versions of them, may also be available in electronic format on the internet at https://posfbbs.appl.wpafb.af.mil or directly from the authors. The overall program accomplishments and details of the individual test devices employed during the contract period are contained in the accompanying volume entitled, "Combustion and Heat Transfer; Volume 1 - Advanced Jet Fuels Studies."
DTIC
Heat Transfer; Combustion; Jet Engine Fuels; Heat of Combustion; Corrosion Tests; Fuel Systems

19990026105 Dayton Univ. Research Inst., Research Inst., OH USA
Combustion and Heat Transfer; Volume 4 - Combustion Data Sets ***Final Report, 8 Jun. 1992 - 31 Dec. 1997***
Ballal, D. R.; Takahashi, F.; Schmoll, W. J.; Vangsness, M. D.; Striebich, R.; Dec. 1997; 106p; In English
Contract(s)/Grant(s): F33615-92-C-2207; AF Proj. 3048
Report No.(s): AD-A359362; UDR-TR-1998-00103-VOL-4; AFRL-PR-WP-TR-1998-2102; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The objective of the proposed research was to develop a fundamental understanding of the combustion process in a gas turbine combustor. Specifically, we performed WSR experiments, vortex-flame interaction studies, flame stabilization research, and studies of turbine blade film cooling. In this report, we present the Combustion Data Sets that may be used by modelers in the industry and elsewhere for evaluating and refining computer models. More exhaustive information is available in the individual papers and reports listed here. All data sets were prepared using Microsoft Office 97 for IBM PC-compatible computers and are available on computer diskettes.
DTIC
Heat Transfer; Combustion; Heat of Combustion; Reaction Kinetics; Chemical Reactions; Combustion Chambers

19990026206 Department of Energy, Office of Energy Research, Washington, DC USA
Renormalization of supersymmetric theories
Pierce, D. M., Department of Energy, USA; Jun. 30, 1998; 49p; In English; Supersymmetry, Supergravity and Supercolliders, 1997, Unknown; Meeting sponsored by Theoretical Advanced Study Inst. in Elementary Particle Physics
Report No.(s): DE98-059278; SLAC-PUB-7937; CONF-9706284; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The author reviews the renormalization of the electroweak sector of the standard model. The derivation also applies to the minimal supersymmetric standard model. He discusses regularization, and the relation between the threshold corrections and the renormalization group equations. He considers the corrections to many precision observables, including M(sub W) and sin(exp 2) theta(sup eff). He shows that global fits to the data exclude regions of supersymmetric model parameter space and lead to lower bounds on superpartner masses.
NTIS
Electroweak Interactions (Field Theory); Renormalization Group Methods; Supersymmetry; Standard Model (Particle Physics); Electroweak Model

19990026347 Department of Energy, Office of Energy Research, Washington, DC USA
Closing the generation gap
Silverstein, E., Department of Energy, USA; Sep. 30, 1997; 9p; In English; Strings, 1997, Unknown
Report No.(s): DE98-059172; SLAC-PUB-7710; CONF-9706271; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The author has explained how the naive obstructions to unifying vacua with different net generation numbers can be overcome, and she gave a class of examples of chirality-changing phase transitions in four dimensions. The interesting to understand whether in fact one can connect all vacua with N less than instructive, once that approach is developed more fully for four-folds.

Perhaps the next in principle question to ask along these lines is whether there could be any physical process which changes the number of supersymmetries.
NTIS
Chirality; Phase Transformations; Fermions; String Theory

19990026525 Department of Energy, Office of Energy Research, Washington, DC USA
Disoriented chiral condensate: Theory and phenomenology
Bjorken, J. D., Department of Energy, USA; Dec. 31, 1997; 20p; In English; 37th; Dynamics of Strong Interactions, Cracow, Poland; Meeting sponsored by Cracow School of Theoretical Physics
Report No.(s): DE98-059178; SLAC-PUB-7720; CONF-9705288; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

These notes are an abbreviated version of lectures given at the 1997 Zakopane School. They contain two topics. The first is a description in elementary terms of the basic ideas underlying the speculative hypothesis that pieces of strong-interaction vacuum with a rotated chiral order parameter, disoriented chiral condensate or DCC, might be produced in high energy elementary particle collisions. The second topic is a discussion of the phenomenological techniques which may be applied to data in order to experimentally search for the existence of DCC.
NTIS
Chirality; Quantum Chromodynamics; Particle Production; Broken Symmetry

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SOCIAL SCIENCES (GENERAL)

Includes educational matters.

19990025192 Bowie State Univ., MD USA
Summer Institute in Engineering and Computer Applications: Learning Through Experience ***Final Report***
Langdon, Joan S., Bowie State Univ., USA; Nov. 1995; 522p; In English
Contract(s)/Grant(s): NAG5-2941
Report No.(s): NASA/CR-97-205877; NAS 1.26:205877; No Copyright; Avail: CASI; A22, Hardcopy; A04, Microfiche

The document describing the Summer Institute project is made up of the following information: Administrative procedures; Seminars/Special Courses/Tours/College fair; Facilities/ Transportation; Staff and Administration; Collaboration; Participant/ Project monitoring and evaluation; Fiscal and developmental activities; Job readiness/Job internship development and placement; and Student Follow-up/Tracking. Appendices include presentations, self-evaluations; abstracts and papers developed by the students during their participation in the program.
CASI
Engineering; Computer Techniques; Education; Universities; NASA Programs

19990025343 Massachusetts Corp. for Educational Telecommunications, Cambridge, MA USA
Aeronautics and Aviation Science: Careers and Opportunities Project ***Interim Report, 1 Jul. 1995 - 30 Jun. 1998***
Texter, P. Cardie, Massachusetts Corp. for Educational Telecommunications, USA; 1998; 455p; In English
Contract(s)/Grant(s): NCC2-915; No Copyright; Avail: CASI; A20, Hardcopy; A04, Microfiche

The National Aeronautics and Space Administration funded project, Aeronautics and Aviation Science: Careers and Opportunities has been in operation since July, 1995. This project operated as a collaboration with Massachusetts Corporation for Educational Telecommunications, the Federal Aviation Administration, Bridgewater State College and four targeted ”core sites” in the greater Boston area. In its first and second years, a video series on aeronautics and aviation science was developed and broadcast via ”live, interactive” satellite feed. Accompanying teacher and student supplementary instructional materials for grades 6-9 were produced and disseminated by the Massachusetts Corporation for Educational Telecommunications (MCET). In the MCET grant application it states that project Take Off! in its initial phase would recruit and train teachers at ”core” sites in the greater Boston area, as well as opening participation to other on-line users of MCET’s satellite feeds. ”Core site” classrooms would become equipped so that teachers and students might become engaged in an interactive format which aimed at not only involving the students during the ”live” broadcast of the instructional video series, but which would encourage participation in electronic information gathering and sharing among participants. As a Take Off! project goal, four schools with a higher than average proportion of minority and underrepresented youth were invited to become involved with the project to give these students the opportunity to consider career exploration and development in the field of science aviation and aeronautics. The four sites chosen to participate

in this project were: East Boston High School, Dorchester High School, Randolph Junior-Senior High School and Malden High School. In year 3 Dorchester was unable to continue to fully participate and exited out. Danvers was added to the ”core site” list in year 3. In consideration of Goals 2000, the National Science Foundation standards for quality of teaching, and an educational agenda that promotes high standards for all students, Aeronautics and Aviation Science: Careers and Opportunities had as its aim to deliver products to schools, both in and outside the project sites, which attempt to incorporate multi-disciplined approaches in the presentation of a curriculum which would be appropriate in any classroom, while also aiming to appeal to young women and minorities. The curriculum was developed to provide students with fundamentals of aeronautics and aviation science. The curriculum also encouraged involving students and teachers in research projects, and further information gathering via electronic bulletin boards and internet capabilities. Though not entirely prescriptive, the curriculum was designed to guide teachers through recommended activities to supplement MCET’s live telecast video presentations. Classroom teachers were encouraged to invite local pilots, meteorologists, and others from the field of aviation and aeronautics, particularly women and minorities to visit schools and to field questions from the students.
Derived from text
NASA Programs; Education; Minorities; Computer Assisted Instruction; On-Line Systems; Aerospace Sciences; Aeronautical Engineering

19990026076 University of Southern California, Integrated Media Systems Center, Los Angeles, CA USA
BioSIGHT: Interactive Visualization Modules for Science Education ***Final Report***
Wong, Wee Ling, University of Southern California, USA; 1998; 6p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG2-6014
Report No.(s): USC-53-4533-1400; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Redefining science education to harness emerging integrated media technologies with innovative pedagogical goals represents a unique challenge. The Integrated Media Systems Center (IMSC) is the only engineering research center in the area of multimedia and creative technologies sponsored by the National Science Foundation. The research program at IMSC is focused on developing advanced technologies that address human-computer interfaces, database management, and high-speed network capabilities. The BioSIGHT project at is a demonstration technology project in the area of education that seeks to address how such emerging multimedia technologies can make an impact on science education. The scope of this project will help solidify NASA’s commitment for the development of innovative educational resources that promotes science literacy for our students and the general population as well. These issues must be addressed as NASA marches toward the goal of enabling human space exploration that requires an understanding of life sciences in space. The IMSC BioSIGHT lab was established with the purpose of developing a novel methodology that will map a high school biology curriculum into a series of interactive visualization modules that can be easily incorporated into a space biology curriculum. Fundamental concepts in general biology must be mastered in order to allow a better understanding and application for space biology. Interactive visualization is a powerful component that can capture the students’ imagination, facilitate their assimilation of complex ideas, and help them develop integrated views of biology. These modules will augment the role of the teacher and will establish the value of student-centered interactivity, both in an individual setting as well as in a collaborative learning environment. Students will be able to interact with the content material, explore new challenges, and perform virtual laboratory simulations. The BioSIGHT effort is truly cross-disciplinary in nature and requires expertise from many areas including Biology, Computer Science Electrical Engineering, Education, and the Cognitive Sciences. The BioSIGHT team includes a scientific illustrator, educational software designer, computer programmers as well as IMSC graduate and undergraduate students.
Derived from text
Computer Systems Programs; Computer Programs; Education; Students; Simulation; Life Sciences; Display Devices

19990026077 Florida International Univ., Mechanical Engineering Dept., Miami, FL USA
Aeronautics Learning Laboratory for Science, Technology, and Research (ALLSTAR) ***Final Report No. 3, 1 Jul. 1997 - 30 Jun. 1998***
Levy, Cesar, Florida International Univ., USA; Ebadian, M. A., Florida International Univ., USA; Aug. 15, 1998; 12p; In English
Contract(s)/Grant(s): NCC2-917; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We finished the material development of Level 1, Level 2 and most of Level 3. We created three new galleries, one of streaming videos enabling the user to select his/her appropriate speed of Internet connectivity for better performance. The second gallery on NASA’s X-series aircraft and the third is on F-series aircraft. We also completed the placement and activation of all thirteen kiosks. We added one more kiosk over the number suggested in the proposal at Baker Aviation High School - a Dade County Public School for special aviation programs. We felt that the goals of this school matched ALLSTAR’s goals and that the placement of the kiosk would better help the local students become interested in the Aviation and Aeronautics field. We continue to work on

the development of our "Teacher Resource Guide to ALLSTAR material" in which we tied our material into the national and Florida State standards. We finished the Florida Sunshine State standards, getting positive feedback from local and other educators who use the material on a regular basis. We had another successful workshop on October 29 th, 1997. We introduced the ALLSTAR website and kiosk to about twenty science and history teachers from Dade County Public Schools (DCPS). Most teachers were from middle schools, although we had some from elementary schools also. We provided several demonstrations of the ALLSTAR material to local schools in the Dade County Public Schools (DCPS) system. We used the ALLSTAR material with FIU's summer immersion program for FLAME students. This program includes a high number of minority students interested in science and engineering. We also presented the material at National Science Teachers Association (NSTA) and National Congress on Aviation and Space Education (NCASE) conferences and will be presenting the material at the Southeast Florida Aviation Consortium (SEFAC). We provided two on-site workshops in the NSTA conference with total attended of about 70 teachers. The BBS was converted to an on-line discussion forum with a unique section on Blacks in Aviation, Prime Technologies coordinated with NASA LaRC and the Teacher Resource Centers (TRCs) for scale-up of ALLSTAR and performed live demonstrations of the software in schools and at conventions.
Derived from text
Aeronautical Engineering; Laboratory Equipment; Laboratories; On-Line Systems; Education

19990026089 Institute for Global Environmental Strategies, Arlington, VA USA
Discover Earth
Steele, Colleen, Institute for Global Environmental Strategies, USA; January 1998; 34p; In English
Contract(s)/Grant(s): NAG5-3889; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Discover Earth is a NASA-sponsored project for teachers of grades 5-12, designed to: (1) enhance understanding of the Earth as an integrated system; (2) enhance the interdisciplinary approach to science instruction; and (3) provide classroom materials that focus on those goals. Discover Earth is conducted by the Institute for Global Environmental Strategies in collaboration with Dr. Eric Barron, Director, Earth System Science Center, The Pennsylvania State University; and Dr. Robert Hudson, Chair, the Department of Meteorology, University of Maryland at College Park. The enclosed materials: (1) represent only part of the Discover Earth materials; (2) were developed by classroom teachers who are participating in the Discover Earth project; (3) utilize an investigative approach and on-line data; and (4) can be effectively adjusted to classrooms with greater/without technology access. The Discover Earth classroom materials focus on the Earth system and key issues of global climate change including topics such as the greenhouse effect, clouds and Earth's radiation balance, surface hydrology and land cover, and volcanoes and climate change. All the materials developed to date are available on line at (http://www.strategies.org) You are encouraged to submit comments and recommendations about these materials to the Discover Earth project manager, contact information is listed below. You are welcome to duplicate all these materials.
Derived from text
Atmospheric Radiation; Climate Change; Earth Sciences; Education; Greenhouse Effect; On-Line Systems

19990026218 USA Space Foundation, Colorado Springs, CO USA
K-12 Aerospace Education Programs ***Final Report, 1998-1999***
January 1999; 9p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG5-3720; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

NASA, the USA Air Force Academy, the Air Force Space Command, the University of Colorado at Colorado Springs (UCCS), and the USA Space Foundation teamed to produce a dynamic and successful graduate course and in-service program for K-12 educators that has a positive impact on education trends across the nation. Since 1986, more than 10,000 educators from across the USA have participated in Space Discovery and Teaching with Space affecting nearly a million students in grades K-12. The programs are designed to prepare educators to use the excitement of space to motivate students in all curriculum subjects.
Derived from text
Armed Forces (USA); Education; Electronic Equipment; Procedures

19990026564 American Inst. of Aeronautics and Astronautics, Reston, VA USA
Development of a teaching tool to encourage high school students to study aerospace technical subjects ***Final Report, 30 Jun. 1997 - 30 Jun. 1998***
Gale, Anita, American Inst. of Aeronautics and Astronautics, USA; Edwards, Dick, American Inst. of Aeronautics and Astronautics, USA; Sep. 23, 1998; 162p; In English
Contract(s)/Grant(s): NAG4-134; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This report details the efforts to develop a design competition aimed at high school students which will encourage them to study aerospace technical subjects. It has been shown that such competitions - based on an industry simulation game - are valuable ways to energize high school students to study in this area. Under the grant, a new competition scenario was developed, in keeping with NASA-Dryden's mission to develop aircraft and foster knowledge about aeronautics. Included are preliminary background materials and information which, if the grant is continued, would form the basis of a national competition for high school students, wherein they would design an Aerospaceport in a future year, taking into consideration the requirements of aircraft, spacecraft-ground transportation systems, passengers who use the facility, and employees who operate it. Many of the Competition methods were studied and tested during two existing local competitions in the disadvantaged communities of Lancaster and Victorville, California.
Author
Education; Competition; Aerospace Engineering; Simulation; Students

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ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

19990025259 Naval Postgraduate School, Monterey, CA USA
How Waivers to the Truth in Negotiations Act May Improve Naval Aviation Acqusition Processes
Cuskey, Jeffrey R.; Nissen, Mark E.; Dec. 1998; 130p; In English
Report No.(s): AD-A359321; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The Truth in Negotiations Act (TINA) requires that Government contractors provide cost or pricing data for procurements equal to or exceeding $500,000 and certify that such data are accurate, current and complete upon agreement of a contracts price. However, preparation, provision and examination of these data are tedious, time-consuming and costly for the contractor and the Government. The objective of this research was to determine how Department of Defense experience with TINA Waivers could be used to improve Naval Aviation acquisition processes. The thesis examines acquisitions made by three aviation procurement organizations using these waivers. The methodology included gathering waiver-related information to assess the overall use, policy and guidance, methodologies, effects and the opinions related to waivers. The findings illustrate that waivers can offer considerable benefits of time and cost savings. However, barriers exist precluding them from regular use. These include approval limitations, a lack of waiver guidance and a limited diversity of waiver use. From these findings, recommendations are made to remove restrictive waiver policies and procedures, reduce the level of approval authority for waivers, increase waiver guidance and approve blanket or class waivers.
DTIC
Procurement; Contractors; Cost Reduction; Defense Program

19990025637 Syracuse Univ., Maxwell School of Citizenship and Public Affairs, NY USA
Managing America to the Moon: A Coalition Analysis, Chapter 8
Lambright, W. Henry, Syracuse Univ., USA; From Engineering Science to Big Science: The NACA and NASA Collier Trophy Research Project Winners; 1998, pp. 193-211; In English; ISBN 0-16-049640-3; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Without question, the lunar landing program - Project Apollo- was one of the greatest examples of technological achievement in history. It was also a great managerial feat. From 1965 through 1971 the Collier trophy was awarded 5 times to NASA for extraordinary Apollo-related accomplishments. The Collier awards really identify particular feats that are representative of the many. While the awards mentions specific managers, or astronauts, what the award is really acknowledging is a large group of individuals and organizations that combined for a relatively brief period of time to accomplish what in retrospect seems extraordinary. This chapter approaches the subject of the Apollo lunar landings as an achievement in program management.
CASI
Lunar Landing; Organizations; Apollo Project; Awards; Project Management; Politics

19990026073 General Accounting Office, National Security and International Affairs Div., Washington, DC USA
Report to the Honorable Tom Harkin, US Senate. Acquisition Management: Workforce Reductions and Contractor Oversight
Jul. 1998; 22p; In English
Report No.(s): GAO/NSIAD-98-127; B-279516; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Federal Restructuring Act of 1994, passed in March 1994 and mandated government-wide reductions of 272,900 full-time equivalent positions through fiscal year 1999. This also affected DOD's acquisition workforce. DOD agencies responsible for contractor oversight, DCAA and DCMC, were not exempted from these reductions. The results of this study show that DOD's acquisition workforce is decreasing slightly faster than DOD's overall workforce. From fiscal year 1993 through fiscal year 1997, the number of personnel in DOD's overall workforce decreased by 17.5 percent. During the same time frame, the number of civilian personnel in DOD's acquisition workforce decreased by 24 percent, while the military personnel in the acquisition workforce decreased by 28 percent. Throughout this 5-year period, DOD's civilian acquisition workforce remained at roughly 30 percent of DOD's overall civilian workforce. Since 1993, the two organizations directly associated with contractor oversight, DCAA and DCMC, have had personnel reductions of roughly 19 and 27 percent, respectively. According to DCAA and DCMC officials, the organizations have implemented a variety of risk-based initiatives and reengineering programs during this time frame as their respective workforces have been reduced. For example, DCAA has implemented risk assessment procedures based on contractor size (the dollar value of contracts) and process reengineering activities in the areas of contractor self-governance and contractor billing. Similarly, DCMC has instituted risk-based initiatives and initiatives aimed at improving efficiency. For example, DCMC'S Performance-Based Assessment Model determines how often and to what extent contractors should be reviewed based on risk potential; the Single Process Initiative encourages the consolidation of common processes in facilities that produce commercial and DOD products.

Derived from text

Congressional Reports; Contractors; Personnel; Defense Program; Reduction; Procurement

19990026302 Royal Aeronautical Society, London, UK

Directing and Managing Cost-Effective Design: Proceedings

Directing and Managing Cost-Effective Design; 1998; 84p; In English; Directing and Managing Cost-Effective Design, 27 Jan. 1998, London, UK; See also 19990026303 through 19990026307; ISBN 1-85768-014-6; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

The experiences of several companies in managing cost reduction of design and engineering projects are presented. The results of using teams and other methods of management used in the British aerospace industry are presented. Six papers were delivered, five are found in this volume. The papers which were delivered are: (1) Driving down product introduction costs - The Airbus experience; (2) The use of cross functional design team practices for cost-effective design; (3) New opportunities and stubborn problems in engineering design; (4) Achieving k-through performance with multi-disciplinary teams; (5) Directing and managing cost-effective design - successes and failures.

CASI

Cost Reduction; Conferences; Management Methods; Project Management

19990026303 British Aerospace Airbus Ltd., Bristol, UK

Driving Down Product Introduction Costs: The "Airbus Experience"

Jupp, J. A., British Aerospace Airbus Ltd., UK; Directing and Managing Cost-Effective Design: Proceedings; 1998, pp. 2.1-2.18; In English; See also 19990026302; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

For some years now, Boeing has "thrown down the gauntlet" to Airbus Industrie by feeding a step change reduction in aircraft pricing into the market place. Airbus has responded and indeed is continuing to win market share. To ensure that the Airbus Partnership continues to build as a the Airbus Partnership continues to build as a profitable business, the partners have risen to the challenge in several ways; from committing to become a "Single Corporate Entity" through to major cost reduction programs both internal and down into their supply base. The British Aerospace Airbus response was to set major internal business improvement goals as targets to be achieved in all areas, working through a company-wide "Performance Improvement Program". In the engineering team at Filton the task started in earnest in 1993 with the "Engineering Review of Operations and Strategy" (EROS), a facilitated program of cross functional process improvement and people development leading very swiftly into a fully cross-business review of the "Product Introduction Process". In 1995 the company reorganized into a Project Team led matrix organization "Product Operations", embedding some of the early "Develop Derivative Product" process development work across the whole business, with engineers seconded into Product - Business multi-disciplined teams. Significant success was achieved, with major "Product Introduction" tasks being completed with up to 40% cost reductions and improved quality. The work also supported a further business objective of driving down the product costs through optimizing the design for low cost manufacture. As well as through 'Process' and 'People' change, we then moved on to integrate new Information Technology (IT) "tools". These three themes were brought together by again using an "on-line" piloting process. This work is still ongoing, but major successes with new Knowledge Based Engineering and CAD/EDM systems are already being achieved in the Nimrod 2000 and A340-600 design

teams, bringing further step change in cost reduction and time compression. This paper describes the process we have gone through in the last five years, some quantified successes achieved, and some of the problems and issues we are still working at to maintain engineering excellence in a product-focused multi-project aerospace development organization. Much has been achieved, but the further we travel along the road towards a 21st Century world class organisation, the more it becomes clear how much there is still to do.
Author
Commerce; Cost Reduction; Costs; Engineers; European Airbus; Product Development; Project Management; UK; Manufacturing

19990026304 Rolls-Royce Ltd., Commercial Aero-Engines, Derby, UK
The Use of Cross Functional Design Team Practices for Cost Effective Design
Mitra, Rajat, Rolls-Royce Ltd., UK; Directing and Managing Cost-Effective Design: Proceedings; 1998, pp. 3.1-3.5; In English; See also 19990026302; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

Rolls-Royce has been practicing Concurrent Engineering in different forms for over the past two decades. As part of the Operating Excellence Initiatives, a joint effort between Rolls-Royce, EDS and A. T Kearney, the Integrated Product Development Business Initiative within Rolls-Royce is making further improvements to the way aircraft engines and their individual components are currently designed, building on todays team based approach. Part of their remit is to provide tools and methodologies to designers that would lead to a more effective, 'right first time' design that addresses the entire product life cycle issues early on in the design process. This reduces the number of changes during the development process and as a result saves describes three such tools, Functional Analysis (FA) sometimes also known as Functional Cost Analysis (FCA), Design for Assembly (DFA) and Design for Manufacture (DFM) which are being made available to designers to complement the current concurrent engineering process. It also briefly touches on the management issues that arise with the introduction of these design team practices.
Author
Commerce; Concurrent Engineering; Cost Effectiveness; Product Development; Engine Design; Project Management

19990026305 Farrar (David J.), Wing, UK
New Opportunities and Stubborn Problems in Engineering Design
Farrar, David J., Farrar (David J.), UK; Directing and Managing Cost-Effective Design: Proceedings; 1998, pp. 4.1-4.9; In English; See also 19990026302; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

Stubborn problems include suboptimization, which in changing forms has persisted in aerospace over the past fifty years. The theme is illustrated from, case histories covering Government procurement, industry direction and management and design education, much of which comes from the authors, involvement in successes and failures, and conversations with and surveys of hundreds of engineers and designers. Benchmarking of company performance in this field shows much scope for improvement. Case histories show how major steps forward were directed and managed. Practical opportunities for improvement are listed and discussed.
Author
Case Histories; Aircraft Industry; Aircraft Design; Design to Cost; Design Analysis; Management Planning; Project Planning; Cost Reduction

19990026306 PA Consulting Group, Melbourn, UK
Achieving Break-Through Performance with Multi-Disciplinary Teams
Lyons, Joe W., PA Consulting Group, UK; Directing and Managing Cost-Effective Design: Proceedings; 1998, pp. 5.1-5.5; In English; See also 19990026302; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

If multi-disciplinary team working is such a good thing, why have not more companies done it? The answer is they have probably tried - some having more success than others. A growing number of companies are recognising that using multi-disciplinary teams has the potential to achieve substantial improvements in the development timescales, the costs and the quality of project work. However, introducing any changes to the way people work can be extremely difficult and many mistakes can be made which slow the progress towards a new way of working. This paper identifies a number of the problems which companies face when introducing team-working and describes how these can be overcome. It addresses three key questions: (1) What are Multi-Disciplinary Teams (MDTs)? (2) What value do they offer? (3) How do they work? The style of management used to support the MDTs requires a radical change in approach over traditional ways of working, if the true benefits of operating a project in this new way

are to be achieved. This paper focuses on exploring what options are appropriate for the management of MDTS, as this is arguably the single most important factor for success. The experience of GEC Marine's Landing Platform Dock (LPD) Replacement Project is used as a case study to show how many of the problems associated with multi- disciplinary teams can be overcome.
Author
Teams; Project Management; Project Planning; Management Planning; Multidisciplinary Design Optimization

19990026307 Dangerfield (K. J.) and Associates, Olveston, UK
Directing and Managing Cost-Effective Design: Successes and Failures
Dangerfield, K. J., Dangerfield (K. J.) and Associates, UK; Directing and Managing Cost-Effective Design: Proceedings; 1998, pp. 6.1-6.35; In English; See also 19990026302; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

This paper is based on a unique opportunity that occurred at Rolls Royce (RR), Bristol in 1974. The company was vertically divided into four directorial areas of Design, Production, Commerce and Finance in the classic western manner. The company history was in "cost plus" contracts and they were in serious financial difficulty with their first private venture. Consultants proposed a group of engineers, outside the organizational structure, to work at the interfaces "to see what could be done about costs" The author volunteered and led the activity for ten years. It was an astonishing voyage of discovery and possibly unique. Finding and removing unnecessary cost turned out to be easy when the right people were given the opportunity and the underlying cause is obvious when seen from outside the organizational structure. by 1983 a simple cost management system had proved successful beyond the most optimistic hopes. The author has since continued this work as a consultant and throughout the 23 years has had significant contact with twenty companies in France, Germany, Italy and the USA and in all of them the causes and extent of unnecessary cost were the same as those revealed at RR. The paper introduces a significant development in the measurement of the business performance of the design activity, linking it directly to operating profit and the asset value of the company. The paper is an attempt to reveal not only what we did, what resulted, and why it worked, in sufficient detail for others to try it, but also why it was necessary to do anything in the first place. A single organizational feature, common to most western companies, is revealed as the root cause of chronic high cost and low profitability and also of the inevitable demise (so far) of all attempted cures. A simple solution is described and recommended.
Author
Cost Effectiveness; Project Management; Cost Reduction; Value Engineering

19990026311 Texas Southern Univ., Houston, TX USA
The Theory of Functionalism and the International Civil Aviation Organization (ICAO): An Analytical Assessment After the First Fifty Years
Nettey, Isaac Richmond, Texas Southern Univ., USA; Collegiate Aviation Review; September 1997, pp. 19-32; In English; See also 19990026308; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The search for world peace has enjoyed perennial attention among scholars and world leaders throughout the ages. Closely allied with the search for world peace is an equally tenacious quest for order, peace and stability in international society. Integrationist theories which postulate the ultimate unification of world communities as a path to world peace constitute one avenue developed by statesmen and political scientists with an interest in world peace. Chief among integrationist theories is the theory of functionalism which gained appreciable currency in the aftermath of World War 1. "Classical functionalism relies upon the cooperative pursuit of common interests in nonpolitical fields to generate political changes conducive to peace" (Claude 1956, p. 405). Fundamental to the theory of functionalism were the seminal writings of David Mitrany (1933, 1943), who contended that with the increase in technological sophistication and the need for systemic solutions to complex problems which transcend national borders, people will ultimately transfer their allegiance from nation states to effective international agencies with functional missions which involve the development of international economic and social cooperation. The ample parameters of functional missions include such specific goals as the eradication of poverty, diseases, illiteracy, economic insecurity, exploitation, as well as the elevation of living standards through reductions in the interference caused by national frontiers in an interdependent global economy and improvements in international air travel and commerce. Functionalism therefore constitutes an important theoretical bedrock for several intergovernmental organizations (IGOS) established to fulfill functional responsibilities in the first half of the twentieth century. Among the IGOs with functional responsibilities is the International Civil Aviation Organization (ICAO) which was formed by 52 nations during the Chicago Conference of 1944. ICAO was formed with the functional mission of ensuring the development of international civil aviation in a safe and orderly manner. As ICAO moves beyond its first half century, it is prudent to conclude that international civil aviation is quite safe and very orderly. After a careful narrative analyses

of the theory of functionalism and ICAO, this paper concludes that the jury may still be out on whether functionalist predictions will ever be validated by a transfer of allegiance from nation states to a functional IGO such as ICAO.
Author
Stability; Politics; Organizations; International Cooperation; Economics; Civil Aviation

19990026313 University of Southern Illinois, Carbondale, IL USA
Educational Requirements for a Career in Airline Management: An Industry Perspective
Kaps, Robert W., University of Southern Illinois, USA; Ruiz, Jose R., University of Southern Illinois, USA; Collegiate Aviation Review; September 1997, pp. 43-57; In English; See also 19990026308; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Presidents at thirty of the top USA airlines were asked to indicate what educational preparation they felt students seeking a career in airline management should possess. They were asked to rate 18 courses offered in the Aviation Management baccalaureate degree curriculum at Southern Illinois University at Carbondale. They were also asked to rank 14 suggested courses from the Council on Aviation Accreditation (CAA) Curriculum Guideline. Following analysis, courses were placed in three categories: Inclusionary, Exclusionary and Uncertain/Diverse. Findings indicate that airline presidents place the greatest value on courses stressing fiscal requirements, legal aspects, airline operations and operating in a global environment. Conversely, courses including Applications of Technical Information, The National Airspace System, Airport Planning, Airport Management, Professional Development and General Aviation Operations were ranked low in importance.
CASI
Education; Requirements; Airline Operations; Management Planning; Management Systems; Information Systems

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DOCUMENTATION AND INFORMATION SCIENCE

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

19990025204 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China
An Object-Oriented Geographic Information System Shell
Chen, Pei-Min, Soochow Univ., Taiwan, Province of China; Tseng, Shou-Yi, Soochow Univ., Taiwan, Province of China; Hou, Young-Chang, National Central Univ., Taiwan, Province of China; Loah, Bin-Bin, National Central Univ., Taiwan, Province of China; Journal of the Chinese Institute of Engineers: Transactions of the Chinese Institute of Engineers, Series A; January 1998; ISSN 0253-3839; Volume 21, No. 1, pp. 21-32; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Geographic information systems (GISs) are required to support a wide range of applications, many of which involve vast quantities of geographic data and a variety of data types, which include vector-form and raster-form spatial data as well as non-spatial data. However, melting vector and raster data and expressing the natural associations between the spatial data and non-spatial data in a GIS cannot be conveniently managed by the traditional record-based system. A system based on an object-oriented paradigm seems to be an appropriate candidate for effectively managing these data since the object-oriented paradigm provides a basic and flexible modeling concept, object, and different modeling mechanisms, such as abstraction, encapsulation, and inheritance, to facilitate the representation and management of diverse geographic data. Thus, spatial data and its relevant non-spatial data as well as the manipulations on them are tied together and represented by an object, which is the basic construction unit of a GIS application. In such a way, the underlying functions and structures of a GIS can be constructed by organizing objects to form a GIS shell, which is the kernel of a GIS. The design of an object-oriented GIS shell based on notations given by the Object Modeling Technique (OMT) is described in this paper. In addition, features provided by the GIS shell are also discussed.
Author
Geographic Information Systems; Object-Oriented Programming; Data Management

19990025219 Department of Energy, Richland Operations Office, Richland, WA USA
Evaluation of Spatial Paradigm for Information Retrieval and Exploration (SPIRE) Technology for Trauma Data Analysis *Final Report*
STEVENS, SAM N.; CALAPRISTI, AUGUSTIN J.; Dec. 1997; 202p; In English
Contract(s)/Grant(s): MIPR-96MM6709
Report No.(s): AD-A359248; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

The U.S. Army Medical Research and Material Command (MRMC) has commissioned the Pacific Northwest National Laboratory to conduct research in applying visualization technologies in a variety of areas of interest to the army. This work included research in the areas of analysis and visualization of information from trauma databases and technical planning documents, exploration of various visualization concepts for analyzing data from medical sensors, reduction of language to mathematics, and technical advancement of text analysis technologies. A number of visualization tools and techniques were applied in each area. One of the major technologies used was the Spatial Paradigm for Information Retrieval and Exploration (SPIRE). SPIRE uses advanced statistics to convert free text into mathematical vectors, which can be analyzed and converted into interactive visualizations. It is designed to produce the analysis and visualizations without requiring the user to have any prior knowledge of the data. This report provides a high-level overview of the activities for the period. Separate reports have been produced for the major areas of research and are attached as appendixes.
DTIC
Diagnosis; Data Management; Software Engineering; Computer Aided Design

19990025286 ISX Corp., Westlake Village, CA USA
Infrastructure for 13 Technology Transition Final Report: Intelligent Integration of Information (13) Initiative ***Final Report, 7 Oct. 1994 - 7 Oct. 1997***
Lehrer, Nancy B.; Dec. 1997; 32p; In English
Contract(s)/Grant(s): F33615-94-C-1556; AF Proj. B765
Report No.(s): AD-A359113; 13BAA-9401; AFRL-IF-WP-TR-1998-1528; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The major goal of the Infrastructure for 13 Technology Transfer (II3TT) project was to show the impact of 13 technology on operational systems development and to provide a framework for measures and metrics which verify this impact. to this end, the II3TT project had two main foci: 1) to provide an infrastructure for 13 program organization and communication based on the then budding young web technology, and 2) to use ISX's ties with other major Defense Advanced Research Projects Agency (DARPA) programs to find marriages between specific operational problems and 13 technology and to develop, where appropriate, feasibility and proof-of-concept systems, which if successful, should lead to major funded efforts of their own.
DTIC
Systems Engineering; Technology Transfer; Management Information Systems; Feasibility

19990025288 West Virginia High Technology Consortium Foundation, Fairmont, WV USA
Automated Conversion of Troubleshooting Information ***Final Report, 30 Sep. 1996 - 30 Sep. 1998***
Jun. 13, 1997; 321p; In English
Contract(s)/Grant(s): N00014-96-1-1272
Report No.(s): AD-A359023; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche

The conversion of troubleshooting information is a formidable problem for the Navy and the DoD. The work described in this final report provides some insight into possible technologies and their contributions to a conversion system. The main objective of the ACT 1 project is to identify technologies that can be utilized as conversion resources, when developing a prototype system for converting troubleshooting information. The report details ways in which, existing and ManTech developed, algorithms can be configured to form a conversion system capable of converting graphic and test based troubleshooting information. Through survey results, ManTech identified the need to identify troubleshooting information in a number of formats. Predominate formats within the survey are tables and flow diagrams. The approach to identification of these tables and flow diagrams requires multifaceted algorithms that can provide robustness across a large population of data. The approach taken is to break the tables and flow diagrams into their fundamental components. For example, a table contains textual elements and graphical elements, in addition to the spatial information. The text items are produced as results of the OCR processing while spatial information is utilized to future define the layout of the information and to determine various relationships within the table flow diagram.
DTIC
Robustness (Mathematics); Prototypes; Graphs (Charts); Algorithms

19990025336 Texas Univ., M. D. Anderson Cancer Center, Houston, TX USA
An Efficient, Lossless Database for Storing and Transmitting Medical Images ***Final Report***
Fenstermacher, Marc J., Texas Univ., USA; Jun. 30, 1998; 6p; In English
Contract(s)/Grant(s): NCC9-36; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This research aimed in creating new compression methods based on the central idea of Set Redundancy Compression (SRC). Set Redundancy refers to the common information that exists in a set of similar images. SRC compression methods take advantage

of this common information and can achieve improved compression of similar images by reducing their Set Redundancy. The current research resulted in the development of three new lossless SRC compression methods: MARS (Median-Aided Region Sorting), MAZE (Max-Aided Zero Elimination) and MaxGBA (Max-Guided Bit Allocation).
Derived from text
Data Bases; Redundancy; Transmission

19990025444 Human Resources Research Organization, Alexandria, VA USA
Data Base Documentation Standards for Extant Datasets ***Final Report, Aug. - Dec. 1996***
DiFazio, Ani S.; Young, Winnie Y.; Jan. 1999; 51p; In English
Contract(s)/Grant(s): MDAA903-93-D-0032
Report No.(s): AD-A359256; FR-EADD-97-05; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Since 1975, the U.S. Army Research Institute (ARI) has collected a wide array of manpower Personnel Research (MPR) data in support of its research activities. Until this current effort, there have been no formal procedures or guidelines for the documentation and archive of these numerous databases. The ability of new users to access and utilize extant ARI data, whether collected by ARI staff or by outside contractors, is heavily dependent on the knowledge of those ARI staff members who worked most closely with the data. With organizational turnover and downsizing, critical information needed to access and use data by new users will be lost over time. As Phase I of a two phase effort, the Human Resources Research Organization (HumRRO), and Fu Associates were awarded a contract to develop standards for documentation and archive of extant ARI datasets. The development of these documentation and archive standards is the subject of this report.
DTIC
Data Bases; Information Retrieval; Data Acquisition

19990025477 Naval Postgraduate School, Monterey, CA USA
A Database Application for the Naval Command Physical Readiness Testing Program
Quinones, Frances M.; Dec. 1998; 119p; In English
Report No.(s): AD-A359137; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

IT-21 envisions a Navy with standardized, state-of-art computer systems. Based on this vision, Naval database management systems will also need to become standardized among Naval commands. Today most commercial off the shelf (COTS) database management systems provide a graphical user interface. Among the many Naval database systems currently in use, the Navy's Physical Readiness Program database has continued to exist at the command level in a DOS version. This version is outdated since it does not reflect current regulations and lacks many capabilities desired by training coordinators. A central question in the design of a graphical user interface is the need to create an application program which will allow Physical Readiness Coordinators at Naval commands to access the Physical Readiness Training database for local personnel in a windows-based environment without the need of a Database Management System environment (such as Microsoft Access). The design recommendations and implementation of a prototype are the primary research areas for this thesis.
DTIC
Data Bases; Graphical User Interface; Data Base Management Systems; Computers

19990025495 Air Force Research Lab., Wright-Patterson AFB, OH USA
Air Force Research Laboratory Manufacturing Technology. 1999 Project Book Update
Jan. 1999; 89p; In English
Report No.(s): AD-A359186; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This document is a supplement to the Air Force Research Laboratory Manufacturing Technology "1998 Project Book." It is not a replacement, but rather an enhancement to an already vital "living" report with the specific purpose of promoting the transfer of technology. It is organized in such a way as to provide information needed to decide whether the technology described will be useful. For further questions or information, the Technology Information Center's telephone number is listed below. In this supplement, new projects since the publication of the 1998 Project Book in November 1997 are summarized on a single page. The summary contains an explanation of the need for the project, the approach taken to accomplish the effort, the benefits expected to be realized, the current status, the name of the project engineer, and the performing contractor. For projects completed since the print- printing of the 1998 Project Book, there is a summary of the final benefits of the program, the status of the final technical report or the report number, and the Project Book page number for reference purposes. For active projects (those described in the

1998 Project Book which are still active), there is information on the current status of the project and the Project Book page number.
DTIC
Manufacturing; Technology Transfer; Information Systems; Augmentation

19990025648 Defense Systems Management School, Fort Belvoir, VA USA
Program Manager
Nov. 1998; 85p; In English
Report No.(s): AD-A359290; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
Program Manager is intended to be a vehicle for the transmission of information on policies, trends, events and current thinking affecting program management and defense systems acquisition.
DTIC
Data Transmission; Management Systems; Policies

19990025777 Massachusetts Univ., Dept. of Computer Science, Amherst, MA USA
Browsing, Discovery and Search in Large Distributed Databases of Complex and Scanned Documents, *1 Oct. - 31 Dec. 1998*
Croft, W. B.; Jan. 14, 1999; 12p; In English
Contract(s)/Grant(s): ARPA ORDER-D570
Report No.(s): AD-A359098; TR5281810199; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
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 full-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 Bases; Data Retrieval; Information Retrieval; On-Line Systems

19990025932 Vanderbilt Univ., School of Engineering, Nashville, TN USA
Minority Engineering Summer Research Program, 1997 *Final Report*
White, Edward J.; Bowers, Alan R.; Jan. 08, 1999; 7p; In English
Contract(s)/Grant(s): N00014971G008
Report No.(s): AD-A359465; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
Selected incoming freshmen ”at risk” students were admitted to the Engineering and Science Summer Research Program with the intent of introducing these students to the classroom and research environment at Vanderbilt University, in addition to presenting to them the wide range of professional opportunities available. Participants also included high school teachers and counselors (previous program participants). The program included workshops, courses, computer skills, field trips, and research projects designed to enhance the probability of academic success. The program appears to have been successful in increasing the academic performance of this group of ”at risk” students.
DTIC
Engineering; Probability Theory; Instructors; Risk

19990026224 Department of Energy, Washington, DC USA
Data archiving in experimental physics
Dalesio, L. R., Department of Energy, USA; Watson, W., Department of Energy, USA; Bickley, M., Department of Energy, USA; Clausen, M., Department of Energy, USA; Dec. 31, 1998; 4p; In English; Accelerator and large experimental physics control systems
Report No.(s): DE98-003469; LA-UR-98-204; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
In experimental physics, data is archived from a wide variety of sources and used for a wide variety of purposes. In each of these environments, trade-offs are made between data storage rate, data availability, and retrieval rate. This paper presents archive

alternatives in EPICS, the overall archiver design and details on the data collection and retrieval requirements, performance studies, design choices, design alternatives, and measurements made on the beta version of the archiver.
NTIS
Data Acquisition; Data Retrieval; Data Storage

19990026228 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA
Symbiotic intelligence: Self-organizing knowledge on distributed networks, driven by human interaction
Johnson, N., Department of Energy, USA; Joslyn, C., Department of Energy, USA; Rocha, L., Department of Energy, USA; Smith, S., Department of Energy, USA; Kantor, M., Department of Energy, USA; Dec. 31, 1998; 12p; In English; 16th; Artificial life
Report No.(s): DE98-003464; LA-UR-98-489; CONF-980669; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This work addresses how human societies, and other diverse and distributed systems, solve collective challenges that are not approachable from the level of the individual, and how the Internet will change the way societies and organizations view problem solving. The authors apply the ideas developed in self-organizing systems to understand self-organization in informational systems. The authors combine an understanding of societal dynamics with self-organization on the Internet (the Net). When the full diversity of societal dynamics is combined with the accuracy of communication on the Net, a phase transition is argued to occur in problem solving capability. Through conceptual examples, an experiment of collective decision making on the Net and a simulation showing the effect of noise and loss on collective decision making, the authors argue that the resulting symbiotic structure of humans and the Net will evolve as an alternative problem solving approach for groups, organizations and society. Self-organizing knowledge formation from this symbiotic intelligence exemplifies a new type of self-organizing system, one without dissipation and not constrained by limited resources.
NTIS
Intelligence; Self Organizing Systems; Problem Solving; Internets; Knowledge

19990026277 Department of Energy, Office of Energy Research, Washington, DC USA
Matrices with low-rank-plus-shift structure: Partial SVD and latent semantic indexing
Zha, H., Department of Energy, USA; Zhang, Z., Department of Energy, USA; Aug. 31, 1998; 17p; In English
Report No.(s): DE98-059390; LBNL-42279; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors present a detailed analysis of matrices satisfying the so-called low-rank-plus-shift property in connection with the computation of their partial singular value decomposition. The application they have in mind is Latent Semantic Indexing for information retrieval where the term-document matrices generated from a text corpus approximately satisfy this property. The analysis is motivated by developing more efficient methods for computing and updating partial SVD of large term-document matrices and gaining deeper understanding of the behavior of the methods in the presence of noise.
NTIS
Information Systems; Information Retrieval; Matrices (Mathematics)

19990026372 Department of Energy, Office of Energy Research, Washington, DC USA
Query estimation and order-optimized iteration in very large federations
Malon, D. M., Department of Energy, USA; May 04, 1998; 6p; In English; Objectivity Worldview '98, 1998, USA
Report No.(s): DE98-057832; ANL/HEP/CP-98-38; CONF-980577; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Objectivity federated databases may contain many terabytes of data and span thousands of files. In such an environment, it is often easy for a user to pose a query that may return an iterator over millions of objects, requiring opening thousands of databases. This presentation describes several technologies developed for such settings: (1) a query estimator, which tells the user how many objects satisfy the query, and how many databases will be touched, prior to opening all of those files; (2) an order-optimized iterator, which behaves like an ordinary iterator except that elements are returned in an order optimized for efficient access, resorted by the database (and container) in which they reside; (3) a parallel implementation of the order-optimized iterator, allowing any number of processes in a parallel or distributed system to iterate over disjoint subcollections of terms satisfying the query, partitioned by the database or container in which the items reside. These technologies have been developed for scientific experiments that will require handling thousands of terabytes of data annually, but they are intended to be applicable in other massive data settings as well. In such environments, significant amounts of data will reside on tertiary storage, accessible via Objectivity's recently-announced HPSS (High Performance Storage System) interface. When deployed in large-scale physics settings later in 1998, the query estimator will further inform the user of the number of tape mounts required to satisfy the query, and provide rough time estimates for data delivery. The order-optimized iterator will be connected to a cache manager that will prefetch from tape

to disk the files needed by the query (known from the query estimation step), and will decide which items to deliver to the user next according to the order in which data become available in the disk cache.
NTIS
Iteration; Query Languages; Federations; Information Systems

19990026505 Science Applications International Corp., Albuquerque, NM USA
Data Collection in an High Level Architecture Federation
Black, Jerry; Dec. 1998; 8p; In English; Presented at the International Test and Evaluation Association Modeling and Simulation Workshop 7-10 Dec 98, LasCruces, NM.
Report No.(s): AD-A359374; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Joint Advanced Distributed Simulation (JADS) Joint Test Force (JTF) is chartered by the Office of the Secretary of Defense to investigate the utility, of advanced distributed simulation (ADS) technology, including the high level architecture (HLA), for test and evaluation (T&E). JADS is executing three formal test programs, including the Electronic Warfare (EW) Test, representing slices of the overall T&E spectrum to form its conclusions. The EW test is using HLA and Runtime Infrastructure (RTI) version 1.3 to support two electronic warfare test events using a distributed cross-country network linking an instrumented EW system, constructive models, and virtual simulations. A method of recording data traffic among federates was required so that accurate latency measurements through the RTI for the JADS federation could be determined JADS considered three possibilities for a logger - a logger federate, logger capabilities incorporated directly into the federate software, and an interface logger. This paper discusses the differences among the types of loggers, the reasons JADS chose to implement the interface logger, and the implementation of the interface logger.
DTIC
Computerized Simulation; Architecture (Computers); Data Acquisition; Systems Simulation

19990026608 General Accounting Office, National Security and International Affairs Div., Washington, DC USA
Acquisition Reform: NASA's Internet Service Improves Access to Contracting Information
Feb. 1999; 25p; In English; Report to Congressional Committees.
Report No.(s): AD-A359835; GAO/NSIAD-99-37; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In response to the Federal Acquisition Streamlining Act (FASA) of 1994, we reviewed the National Aeronautics and Space Administration's (NASA) Acquisition Internet Service (NAIS). Specifically, we determined whether NAIS was an effective mechanism for disseminating procurement information to industry, including small businesses. In addition, we identified the status of efforts to develop a government wide electronic procurement information system similar to NMS. In 1993, NASA began an initiative called the Midrange Pilot Program for procurements between $25,000 and $500,000. The purpose of the program was to test new processes and tools to streamline the acquisition process while maintaining or improving the quality of procurements. A key objective of the program was to develop and test an alternative to paper documents as the primary means of communicating procurement information to prospective contractors. After researching available options, NASA chose to implement an Internet-based electronic procurement notice and publication system, which ultimately became NAIS.
DTIC
Information Systems; Internets; Information Dissemination; Congressional Reports; Governments

19990026640 Department of the Navy, Washington, DC USA
Automatic Message Filing System
Sep. 08, 1998; 17p; In English
Patent Info.: US-Patent-Appl-SN-152,465
Report No.(s): AD-D019259; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An automated message filing system includes a teletype machine having an input for receiving data and at least one port member for enabling a bidirectional transfer of the received data. A computer is also provided having at least one port member for enabling a bidirectional transfer of data, a display, and a data storage area. A converter links the at least one port of the teletype machine with the at least one port of the computer, the converter enabling conversion of teletype data to computer data. Accordingly, data received by the teletype machine is converted by the converter into data readable and storable by the computer.
DTIC
Message Processing; Messages; Teletypewriter Systems

19990026642 Georgia Inst. of Tech., School of Industrial and Systems Engineering, Atlanta, GA USA

Prototype and Evaluation of AutoHelp: A Case-based, Web-accessible Help Desk System for EOSDIS ***Final Report***

Mitchell, Christine M., Georgia Inst. of Tech., USA; Thurman, David A., Georgia Inst. of Tech., USA; [1999]; 21p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

AutoHelp is a case-based, Web-accessible help desk for users of the EOSDIS. Its uses a combination of advanced computer and Web technologies, knowledge-based systems tools, and cognitive engineering to offload the current, person-intensive, help desk facilities at the DAACs. As a case-based system, AutoHelp starts with an organized database of previous help requests (questions and answers) indexed by a hierarchical category structure that facilitates recognition by persons seeking assistance. As an initial proof-of-concept demonstration, a month of email help requests to the Goddard DAAC were analyzed and partially organized into help request cases. These cases were then categorized to create a preliminary case indexing system, or category structure. This category structure allows potential users to identify or recognize categories of questions, responses, and sample cases similar to their needs. Year one of this research project focused on the development of a technology demonstration. User assistance 'cases' are stored in an Oracle database in a combination of tables linking prototypical questions with responses and detailed examples from the email help requests analyzed to date. When a potential user accesses the AutoHelp system, a Web server provides a Java applet that displays the category structure of the help case base organized by the needs of previous users. When the user identifies or requests a particular type of assistance, the applet uses Java database connectivity (JDBC) software to access the database and extract the relevant cases. The demonstration will include an on-line presentation of how AutoHelp is currently structured. We will show how a user might request assistance via the Web interface and how the AutoHelp case base provides assistance. The presentation will describe the DAAC data collection, case definition, and organization to date, as well as the AutoHelp architecture. It will conclude with the year 2 proposal to more fully develop the case base, the user interface (including the category structure), interface with the current DAAC Help System, the development of tools to add new cases, and user testing and evaluation at (perhaps) the Goddard DAAC.

Author

On-Line Systems; EOS Data and Information System; Applications Programs (Computers); Prototypes; Java (Programming Language); Data Acquisition; Computer Systems Design

19990026685 Department of Energy, Office of Energy Research, Washington, DC USA

Genome Channel and Genome Annotation Consortium

Uberbacher, E., Department of Energy, USA; Mural, R., Department of Energy, USA; Shah, M., Department of Energy, USA; Sep. 30, 1997; 6p; In English; 6th; Sponsored by Department of Energy, USA

Report No.(s): DE97-009328; ORNL/CP-94804; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Human and model organism sequencing projects will soon be producing data at a rate which will require new methods and infrastructure for users to be able to effectively view and understand the data. A multi-institutional project was recently funded to provide large-scale analytical processing capabilities and the authors present the results of several pilot efforts related to this project. The goals of the project are as follows: provide an environment where annotation can be constructed based on multiple interoperable analysis tools and significant available computing power; provide an environment where characterization of long genomic sequence regions can be facilitated and analysis can maintained and updated over time; provide an interactive graphical environment where predictions, features and evidence from many tools can be combined by users into high-quality annotation and visualized by the community; provide high-throughput automated analysis methods which can be configured by genome centers for their use in constructing annotation and facilitating data submission; provide high-quality annotation to large genomic sequence regions which would otherwise go unannotated; and provide the community with the best sequence level view of genomes possible. The components of this system are a number of services, a broker that oversees the distribution and management of tasks and a data warehouse, with services implemented using distributed object technology. Multiple gene prediction is accomplished using several gene finding tools including the GRAIL-EST system and gene annotation from databases such as Genbank is also captured. The data warehouse supporting the Genome Channel view is updated daily by automated Internet agents and event triggers which facilitate analysis procedures.

NTIS

Management Systems; Chromosomes; Annotations; Genetics

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ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

19990026332 Analytical Processes/Engineered Solutions, Inc., Saint Louis, MO USA
Corrosion is a Structural and Economic Problem: Transforming Metrics to a Life Prediction Method
Brooks, Craig L., Analytical Processes/Engineered Solutions, Inc., USA; Prost-Domasky, Scott, Analytical Processes/Engineered Solutions, Inc., USA; Honeycutt, Kyle, Analytical Processes/Engineered Solutions, Inc., USA; Fatigue in the Presence of Corrosion; March 1999; 12p; In English; See also 19990026320; Sponsored in part by NCI, Inc.
Contract(s)/Grant(s): NCI-USAF-9061-007; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper advocates a basic engineering approach to compute the effects of corrosion on structural capability. The analyses use fracture mechanics methods and fundamental engineering principles. Engineering computations are combined with damage tolerance assessment concepts to formulate a model to approximate the life degradation effects of corrosion. The methods and assumptions used in the analyses are based on reasonable physical characteristics. Where scientific data is unknown, rational judgements are made and several options are explored to bracket the results in terms of the assumptions. Sensitivities of the parameters are examined to establish overall relevance of results. Although the life predictions are calculated using deterministic techniques, the scope of the problem and thus the life impacts computed should be considered as probabilistic. The results of this approach provide the analyst with numerical impacts of potential scenarios and a means for quantifying the effects of corrosion with fatigue. The results also provide a ”benchmark” for methodology improvements as new data and information are obtained. Crack growth life analyses of particular geometry configurations are used to show the relative life impact of corrosion metrics. For example, typical surface morphologies generated by corrosion in a lap joint are evaluated. The local stress amplification due to the corrosion roughness reduced the regional crack growth capability of a surface crack by 70%. The impact of sustained stress build-up caused by corrosion-induced pillowing in a lap joint degraded structural life 25 to 35% for a crack adjacent to a fastener hole. These results represent the level of potential life degradation that could be realized in the corroded regions. The individual models isolate the contribution of effects attributed to corrosion (i.e., pillowing, surface morphologies, etc.) and analysis results emphasize the need to include corrosion parameters in a component service life assessment. A simulation of a pressurized fuselage skin splice is used to illustrate the analytically derived impact to the life and safety of the joint in the presence of corrosion. The analysis includes time-dependent effects of corrosion into the structural life prediction for a multi-site damage (MSD) scenario. Twenty and fifty year corrosion assumptions are used based upon conditions found in existing aircraft. The results of this analysis indicate that corrosion is a potential structural problem for the particular aircraft locations that are experiencing this type of corrosion attack. This paper presents the methodology for computing the effects of real time ’age degradation’ on an aircraft structure. So it provides a means of using the existing Structural Integrity process to meet the needs, opportunities and challenges being presented by the aging aircraft fleet.
Author
Fatigue (Materials); Corrosion; Structural Failure; Aircraft Structures; Crack Propagation; Fracture Mechanics; Degradation; Surface Cracks; Aircraft Maintenance

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URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation. For related information see also 03 Air Transportation and Safety, 16 Space Transportation, and 44 Energy Production and Conversion.

19990025475 Air War Coll., Maxwell AFB, AL USA
Seller Beware US International Technology Transfer and Its Impact on National Security
Johnson, Wayne M.; Dec. 1998; 35p; In English
Report No.(s): AD-A359122; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

As was the case during the cold war, the national military strategy of the USA relies on technologically superior forces to achieve our objectives when the armed forces are called on to protect the USA and its interests. However, as the military downsizes, preserving a technologically superior force while also maintaining a robust defense industrial base becomes more difficult. One means the USA uses to preserve the industrial base is to maintain demand by selling our military goods to other countries. While foreign military sales (FMS) alone will not keep the US industrial base viable, they have become more significant than in the days of larger US defense procurements. In 1996, for example. FMS exceeded $10 billion. Indeed, FMS can spell the difference

between continued existence and bankruptcy for some of our defense contractors. The perceived need to sell overseas while safeguarding US advanced technologies appears to be a conflicting goal because of the technology transfer involved. In this important study, the author argues that systematic tightening of interagency cooperation and better work on defining sensitive technology prohibitions are needed to maintain the US technological edge. He also maintains that the US government requires a new and disciplined export control process-not the current mosaic of rules, regulations, and perspectives that came out of the cold war, but a process that provides a revamped, systemic approach with consistent implementation. Colonel Johnson explores the problem of defining which technologies the USA Is willing to transfer (military or dual-use) and the need to ensure that national security objectives do not take a backseat to economic expediency. to accomplish this end, he argues for better interagency cooperation as a first step leading to a more centralized, coordinated, and strategic view of technology transfer and how it impacts US national security.
DTIC
Technology Transfer; International Relations; Security; Military Operations

19990026424 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA
Developing new levels of edit
Prono, J., Department of Energy, USA; DeLanoy, M., Department of Energy, USA; Deupree, R., Department of Energy, USA; Skiby, J., Department of Energy, USA; Thompson, B., Department of Energy, USA; Dec. 31, 1998; 5p; In English; 45th; Meeting sponsored in part by Society for Technical Communications
Report No.(s): DE98-003474; LA-UR-98-373; CONF-980568; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In 1985, the writing and editing group at Los Alamos National Laboratory established four levels of edit for technical reports. When a survey in 1994 showed that both authors and editors felt the levels were not meeting author needs, the authors set about revising them. Their goals were to simplify the editing process, focus editing on improving technical clarity, and ensure that value was added in editing. This paper describes the revision process and product -- three author-based levels of edit.
NTIS
Editing; Information; Correction; Revisions

19990026562 Kyushu Univ., Faculty of Engineering, Fukuoka, Japan
A Comparative Study of the Technology Transfer Systems from University to Private Sector in Japan and USA
Technology Reports of Kyushu University; Jan. 1998; Volume 71, No. 1, pp. 25-31; In Japanese; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The system for technology transfer from university to private sector in Japan is different from that in the USA in the following points: a) the assignment of inventions; b) the management and process of patent and licensing; c) the incentive to university and inventor. These differences may reflect the ability and the effect to create new industry by the use of technologies and products of university, and determine the future global competition between Japan and the USA.
Author
Technology Transfer; Research and Development; Japan; USA; Universities

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ASTRONOMY

Includes radio, gamma-ray, and infrared astronomy, and astrometry.

19990025562 NASA Goddard Space Flight Center, Greenbelt, MD USA
ASCA Observation of the Dipping X-Ray Source X1916-053
Ko, Yuan-Kuen, NASA Goddard Space Flight Center, USA; Makai, Koji, Universities Space Research Association, USA; Smale, Alan P., Universities Space Research Association, USA; White, Nick E., NASA Goddard Space Flight Center, USA; 1997; 14p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present the results of timing and spectral studies of the dipping X-ray source X1916-053, observed by ASCA during its Performance Verification phase. The detected dipping activity is consistent with previous observations, with a period of 3008s and an intermittent secondary dip observed roughly 0.4 out of phase with the primary dip. The energy spectra of different intensity states are fitted with a power law with partial covering fraction absorption and interstellar absorption. The increase in the hardness ratio during the primary and secondary dips, and the increase in the covering fraction and column density with decreasing X-ray intensity, all imply that the dipping is caused by the photo-absorbing materials which have been suggested to be where the accreted

flow hits the outer edge of the disk materials. The spectra at all intensity levels show no apparent evidence for Fe or Ne emission lines. This may be due to the low metal abundance in the accretion flow. Alternatively, the X-ray luminosity of the central source may be too weak to excite emission lines, which are assumed to be produced by X-ray photoionization of the disk materials.
Author
X Ray Astronomy; X Ray Spectra; X Ray Binaries; Periodic Variations; Emission Spectra; Energy Spectra

19990025581 Maryland Univ. Baltimore County, Catonsville, MD USA
The Hubble Space Telescope Servicing Mission, Chapter 16
Tatarewicz, Joseph N., Maryland Univ. Baltimore County, USA; From Engineering Science to Big Science: The NACA and NASA Collier Trophy Research Project Winners; 1998, pp. 365-396; In English; ISBN 0-16-049640-3; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Hubble Space Telescope (HST) servicing mission was awarded the Collier Trophy for 1994. The comprehensive servicing was required because the HST had developed a seemingly fatal; and irreparable manufacturing flaw that would severely degrade or even scuttle its fifteen year mission. This essay summarizes the problems with the HST, both managerial and technical, and the work which went into the solution, culminating with the successful servicing mission.
CASI
Orbital Servicing; Mirrors; Hubble Space Telescope; Space Shuttle Mission 61-E; Discovery (Orbiter)

19990025887 Columbia Univ., Columbia Astrophysics Lab., New York, NY USA
Observations of the Neuton Star RXJ0002.9 + 6246 ***Final Report, 1 Jun. 1997 - 31 May 1998***
Hailey, Charles J., Columbia Univ., USA; Nov. 1998; 2p; In English
Contract(s)/Grant(s): NAG5-4759
Report No.(s): CAL-3060; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The High Resolution Imager (HRI) observation of the CTB1 region requested in the original proposal was performed and data received. The primary target, the candidate neutron star, was detected at the predicted intensity. As proposed, both timing and spatial extent analysis has been performed on the extracted photons. The preliminary timing analysis showed no evidence for the faint pulsations seen in the PSPC data. As the pulse fraction was rather small, this was not an unexpected result. We have, however, recently developed more sophisticated timing analysis capabilities and are in the process of reanalyzing the data to more accurately constrain the pulse fraction, if indeed any evidence for pulsation is found. We have supplemented the HRI observations with optical observations. Filter images, in BVR & I, have been obtained as well as spectra for candidate counterparts. As of this writing, the original analysis holds, i.e. the x-ray flux is not consistent with the L(sub x)/L(sub opt) ratios expected from the candidate stars within the 3 sigma positional error circles. HRI confirmation of the flux as well as the refinement of the position have allowed us to limit the candidate list and refine the original L(sub x)/L(sub opt) analysis.
Derived from text
Neutron Stars; Periodic Variations; X Ray Astronomy

19990026011 Colorado Univ., Joint Inst. for Lab. Astrophysics, Boulder, CO USA
The Physical Interpretation of X-Ray Phase Lags and Coherence: RXTE Observations of Cygnus X-1 as a Case Study
Nowak, M. A., Colorado Univ., USA; Dove, J. B., Wyoming Univ., USA; Vaughan, B. A., California Inst. of Tech., USA; Wilms, J., Colorado Univ., USA; Begelman, M. C., Colorado Univ., USA; Nuclear Physics B (Proceedings Supplements); Jan. 01, 1998; ISSN 0920-5632; Volume 69, Nos. 1-3, pp. 302-307; In English
Contract(s)/Grant(s): NAG5-3225; NAG5-3310; NAG5-2026; NAG5-3239; NSF AST-91-20599; NSF AST-95-13899; DARA-50-OR-92054; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

There have been a number of recent spectral models that have been successful in reproducing the observed X-ray spectra of galactic black hole candidates (GBHC). However, there still exists controversy over such issues as: what are the sources of hard radiation, what is the system's geometry, is the accretion efficient or inefficient, etc. A potentially powerful tool for distinguishing among these possibilities, made possible by the Rossi X-ray Timing Explorer (RXTE), is the variability data, especially the observed phase lags and variability coherence. These data, in conjunction with spectral modeling, have the potential of determining physical sizes of the system, as well as placing strong constraints on both Compton corona and advection models. As an example, we present RXTE variability data of Cygnus X-1.
Author
X Ray Spectra; Phase Coherence; Black Holes (Astronomy); Coronas; X Rays

19990026099 Smithsonian Astrophysical Observatory, Cambridge, MA USA
ASCA Observations of W44 ***Final Report, 1 Jun. 1994 - 30 Nov. 1997***
Hughes, John P., Smithsonian Astrophysical Observatory, USA; 1999; 8p; In English
Contract(s)/Grant(s): NAG5-2605
Report No.(s): Contrib-595; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We report the detection, using data from the Advanced Satellite for Cosmology and Astrophysics (ASCA), of a hard X-ray source in the vicinity of the radio pulsar PSR B1853+01, which is located within the supernova remnant (SNR) W44. PSR B1853+01, a 267 ms pulsar, has to date been detected only in the radio band. Previous observations at soft X-ray energies (e.g., with ROSAT HRI) have failed to detect any significant X-ray emission (pulsed or unpulsed) from the pulsar. In addition, no high-energy emission (approx. greater than 4 keV) has been detected previously from W44. Over the 0.5-4.0 keV band, the ASCA data show soft thermal emission from W44, with a morphology very similar to that observed earlier by Einstein and ROSAT. In the high-energy band (4.0-9.5 keV), the SNR is, for the most part, invisible, although a source coincident with the position of PSR B1853+01 is evident. The observed ASCA spectra are consistent with a power-law origin (photon index approx. 2.3) for the X-ray emission from this source at a flux level (flux density approx. 0.5 micro Jy at I keV) consistent with previous upper limits. The maximum allowed size for the source is determined directiv from the ASCA data (less than 5 min.), while the minimum size is derived from the nondetection of a point source in the ROSAT HRI data (approx. greater than 30 sec.). Timing analysis of the hard X-ray source failed to detect pulsations at the pulsar's period. Based on these lines of evidence, we conclude that the new hard source in W44 represents an X-ray synchrotron nebula associated with PSR B1853+01, rather than the beamed output of the pulsar itself. This discoverv adds W44 to the small group of previously known plerionic SNRs This nebula lies at the low end of, but is consistent with, the correlation between X-ray luminosity and pulsar spin-down energy loss found for such objects, lending further support to our interpretation.
Author
Observation; Energy Dissipation; Flux Density; Nebulae; Pulsars; Satellite Observation; Supernova Remnants

19990026100 Smithsonian Astrophysical Observatory, Cambridge, MA USA
ROSAT PSPC and HRI Observations of Supernova Remnant G292.0+1.8 ***Final Report, 15 Oct. 1992 - 14 Nov. 1994***
Hughes, John P., Smithsonian Astrophysical Observatory, USA; January 1999; 2p; In English
Contract(s)/Grant(s): NAG5-2119; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The supernova remnant G292.0+1.8 was observed by the ROSAT PSPC for 18 ksec as part of this grant. Considerable effort was put into the analysis of the PSPC spectra. The major work went into nonequilibrium ionization joint spectral fits with the Einstein SSS and EXOSAT ME data which indicated that the two spatial regions of this remnant (a central bar and a plateau region covering a larger extent) had similar abundances, but different excitation conditions (temperature and ionization state), an important conclusion, if true. Unfortunately as this work was being finished, new ASCA data revealed the presence of a previously unknown, spectrally hard X-ray source near the center of the remnant which contaminated the SSS and ME data and as a consequence made our detailed spectral analysis done up until then un-publishable. We searched for evidence of this hard source in the PSPC data both spectrally and using timing searches (for a pulsar), but found nothing significant. ROSAT HRI data were also obtained on this remnant. These data were compared to the Einstein HRI data to search for evidence of spectral variations with position and possible expansion of the X-ray remnant. One feature in the remnant appears to have changed in brightness although it is not clear what is the cause of the change. No evidence for the hard ASCA source was apparent in the HRI data.
Derived from text
Supernova Remnants; Observation; Nonequilibrium Ionization; Spectrum Analysis; X Ray Sources

19990026196 California Univ., San Diego, Center for Astrophysics and Space Sciences, La Jolla, CA USA
Guaranteed Time Observations Support for Goddard High Resolution Spectrograph (GHRS) on HST ***Final Report, 15 Nov. 1992 - 14 Nov. 1998***
Beaver, Edward, California Univ., San Diego, USA; 1998; 18p; In English
Contract(s)/Grant(s): NAG5-1858; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We assemble this final grant report by combining our previously submitted progress reports with the last year's progress report. Section 2 is the progress report for the June 1, 1991 to Nov. 14, 1995 period. Section 4 is the progress report for the Nov. 14, 1996 to Dec. 31, 1996 period. Section 5 is the progress report for the Nov. 14 to Aug. 31, 1997 period. Section 6 is the new progress report for the Sept. 15, 1997 to Nov. 14, 1998 final period. Section 3 is a summary of our spare detector high voltage

transient tests activity in 1992 in support of the renewed safe operation of the GHRS HST D1 detector. Note that we have left the format of each progress report the same as originally sent out. The slight differences in format presentation are thus intended.
Author
High Resolution; Spectrographs; Binary Stars; Stellar Mass Accretion; Ultraviolet Spectra; Lyman Alpha Radiation; Ultraviolet Astronomy

19990026219 State Univ. of New York, Stony Brook, NY USA
Chromospheric Doppler Imaging ***Final Report***
Walter, Frederick M., State Univ. of New York, USA; [1997]; 1p; In English
Contract(s)/Grant(s): NAG5-2983
Report No.(s): SUNY-431-0444A; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We reanalyzed the IUE data from the 1991, 1993, and 1995 AR Lac campaigns. Doppler imaging analyses show evidence for asymmetric chromospheric flux distributions, but the plages are not as compact as they were in the 1980's. The expected 1997 data were not obtained due to the failure of the IUE. A discussion of the data, the problems, and the initial results, is in "Stellar Chromospheres", F.M. Walter, in "Stellar Surface Structure", ed. K.G. Strassmeier & J.L. Linsky (Dordrecht:Kluwer) (1996), p. 355. We are currently working on a paper based on this work.
Author
Chromosphere; Imaging Techniques; Data Management

19990026256 NASA Marshall Space Flight Center, Huntsville, AL USA
A Multi-Year Light Curve of Scorpius X-1 Based on CGRO BATSE Spectroscopy Detector Observations
McNamara, B. J., New Mexico State Univ., USA; Harrison, T. E., New Mexico State Univ., USA; Mason, P. A., New Mexico State Univ., USA; Templeton, M., New Mexico State Univ., USA; Heikkila, C. W., New Mexico State Univ., USA; Buckley, T., New Mexico State Univ., USA; Galvan, E., New Mexico State Univ., USA; Silva, A., New Mexico State Univ., USA; Harmon, B. A., NASA Marshall Space Flight Center, USA; Astrophysical Journal; 1998; 2p; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

A multi-year light curve of the low mass X-ray binary, Scorpius X-1, is constructed based on the Compton Gamma-ray Observatory (CGRO) Burst and Transient Source Experiment (BATSE) Spectroscopy Detector (SD) data in the nominal energy range of 10-20 keV. A detailed discussion is given of the reduction process of the BATSE/SD data. Corrections to the SD measurements are made for off-axis pointings, spectral and bandpass changes, and differences in the eight SD sensitivities. The resulting 4.4 year Sco X-1 SD light curve is characterized in terms of the time scales over which various types of emission changes occur. This light curve is then compared with Sco X-1 light curves obtained by Axiel 5, the BATSE Large Area Detectors (LADs), and the RXTE all-sky monitor (ASM). Coincident temporal coverage by the BATSE/SD and RXTE/ASM allows a direct comparison of the behavior of Sco X-1 over a range of high energies to be made. These ASM light curves are then used to discuss model constraints on the Sco X-1 system.
Author
Light Curve; Data Acquisition; Observation; X Ray Binaries; Spectra; Scorpius Constellation; Gamma Rays

19990026270 National Optical Astronomy Observatories, Tucson, AZ USA
Volume-Phase Holographic Gratings and their Potential for Astronomical Applications
Barden, Samuel C., National Optical Astronomy Observatories, USA; Arns, James A., Kaiser Optical Systems, Inc., USA; Colburn, Willis S., Kaiser Optical Systems, Inc., USA; Mar. 1998; 14p; In English
Report No.(s): NOAO-Preprint-781; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A diffraction grating technology based upon volume-phase holograms shows promise of enhanced performance for many applications in astronomical spectroscopy over classical surface-relief grating technology. We present a discussion of the underlying physics of a volume-phase grating, give some theoretical performance characteristics, present performance data for a real volume-phase grating, and discuss some potential applications for this grating technology.
Author
Astronomical Spectroscopy; Gratings (Spectra); Holography

19990026271 National Optical Astronomy Observatories, Tucson, AZ USA
The Delta-Scuti Star GSC 2985 01044
Kinman, T. D., Kitt Peak National Observatory, USA; Aug. 1998; 36p; In English
Report No.(s): NOAO-Preprint-812; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Guide Star Catalog (GSC) 2985 01044 is a Delta Scuti star with a period of 0.0933584 days and a V magnitude range of 11.85 to 12.05; its light curve is slightly variable. The location, space motion and other properties of this star indicate that it is a higher-amplitude Delta Scuti star (or "Dwarf Cepheid") that is a member of the old disk population. The problem of determining the local space densities of the various populations of the higher-amplitude S Scuti stars is discussed.
Author
Cepheid Variables; Light Curve; S Stars; Scutum Constellation; Variable Stars; Dwarf Stars

19990026380 Department of Energy, Washington, DC USA
Direct imaging of extra-solar planets
Olivier, S. S., Department of Energy, USA; Max, V. E., Department of Energy, USA; Brase, J. M., Department of Energy, USA; Caffano, C. J., Department of Energy, USA; Gavel, D. T., Department of Energy, USA; Mar. 01, 1997; 12p; In English; Brown Dwarfs and Extra-Solar Planets, USA
Report No.(s): DE98-050881; UCRL-JC-127489; CONF-9703125; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Direct imaging of extra-solar planets may be possible with the new generation of large ground-based telescopes equipped with state- of- the-art adaptive optics (AO) systems to compensate for the blurring effect of the Earth's atmosphere. The first of these systems is scheduled to begin operation in 1998 on the 10 in Keck II telescope. In this paper, general formulas for high-contrast imaging with AO systems are presented and used to calculate the sensitivity of the Keck AO system. The results of these calculations show that the Keck AO system should achieve the sensitivity necessary to detect giant planets around several nearby bright stars.
NTIS
Telescopes; Image Processing; Conferences; Imaging Techniques; Extrasolar Planets; Gas Giant Planets; Adaptive Optics

19990026697 Smithsonian Astrophysical Observatory, Cambridge, MA USA
Elemental Abundances in the Intracluster Gas and the Hot Galactic Coronae in Cluster A194 ***Interim Report, 15 Jun. 1996 - 14 Jun. 1997***
Forman, William R., Smithsonian Astrophysical Observatory, USA; May 1997; 10p; In English
Contract(s)/Grant(s): NAG5-2611
Report No.(s): NASA/CR-1997-204481; NAS 1.26:204481; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We have completed the analysis of observations of the Coma cluster and are continuing analysis of A1367 both of which are shown to be merging clusters. Also, we are analyzing observations of the Centaurus cluster which we see as a merger based in both its temperature and surface brightness distributions. Attachment: Another collision for the coma cluster.
Author
Galactic Clusters; Emission; Cosmic Gases; Coronas

90
ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust. For related information see also 75 Plasma Physics.

19990025447 Hawaii Univ., Inst. for Astronomy, Honolulu, HI USA
Analysis of Mauna Kea Imaging of Comet Shoemaker-Levy 9 ***Final Report, 1 Aug. 1995 - 31 Jul. 1998***
Jewitt, David, Hawaii Univ., USA; 1998; 2p; In English
Contract(s)/Grant(s): NAGw-4816; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The aim of this proposal was to analyse a set of charge-coupled device images of the Jupiter-impacting comet D/Shoemaker-Levy 9. The images were obtained primarily using the University of Hawaii 2.2-m telescope and a standardized imaging device, providing an unusually uniform set of data. Additional data included a set of spectra taken in search of gaseous emission from SL9 using the UH 2.2-m and Keck 10-m telescopes.
Derived from text
Imaging Techniques; Shoemaker-Levy 9 Comet; Charge Coupled Devices

19990025593 Colorado Univ., Joint Inst. for Lab. Astrophysics, Boulder, CO USA

RXTE Observation of Cygnus X-1, Report 2, TIming Analysis

Nowak, Michael A., Colorado Univ., USA; Vaughan, Brian A., California Inst. of Tech., USA; Wilms, Joern, Tuebingen Univ., Germany; Dove, James B., Colorado Univ., USA; Begelman, Mitchell C., Colorado Univ., USA; Astrophysical Journal; Apr. 03, 1998; 20p; In English

Contract(s)/Grant(s): NSF AST-91-20599; NSF AST-95-29175; NSF INT-95-13899; NAG5-2026; NAG5-3225; NAG5-3310; DARA-50-OR-92054

Report No.(s): astro-ph/9807278; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present timing analysis for a Rossi X-ray Timing Explorer (RXTE) observation of Cygnus X-1 in its hard/low state. This was the first RXTE observation of Cyg X-1 taken after it transited back to this state from its soft/high state. RXTE's large effective area, superior timing capabilities, and ability to obtain long, uninterrupted observations have allowed us to obtain measurements of the power spectral density (PSD), coherence function, and Fourier time lags to a decade lower in frequency and half a decade higher in frequency than typically was achieved with previous instruments. Notable aspects of our observations include a weak 0.005 Hz feature in the PSD coincident with a coherence recovery; a 'hardening' of the high-frequency PSD with increasing energy; a broad frequency range measurement of the coherence function, revealing rollovers from unity coherence at both low and high frequency; and an accurate determination of the Fourier time lags over two and a half decades in frequency. As has been noted in previous similar observations, the time delay is approximately proportional to f(exp -0.7), and at a fixed Fourier frequency the time delay of the hard X-rays compared to the softest energy channel tends to increase logarithmically with energy. Curiously, the 0.01-0.2 Hz coherence between the highest and lowest energy bands is actually slightly greater than the coherence between the second highest and lowest energy bands. We carefully describe all of the analysis techniques used in this paper, and we make comparisons of the data to general theoretical expectations. In a companion paper, we make specific comparisons to a Compton corona model that we have successfully used to describe the energy spectral data from this observation.

Author

X Ray Astronomy; Emission Spectra; Black Holes (Astronomy); Time Lag; Periodic Variations; Energy Spectra; Power Spectra; X Ray Spectra; X Ray Binaries

19990025594 Hawaii Univ., Institute for Astronomy, Honolulu, HI USA

Submillimeter Continuum Observations of Comets ***Final Report, 1 Mar. 1994 - 28 Feb. 1998***

Jewitt, David, Hawaii Univ., USA; 1998; 3p; In English

Contract(s)/Grant(s): NAGw-3973; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The aim of this proposal was to study the submillimeter continuum emission from comets. The study was based mainly on the exploitation of the world's leading submillimeter telescope, the JCMT (James Clerk Maxwell Telescope) on Mauna Kea. Submillimeter wavelengths provide a unique view of cometary physics for one main reason. The cometary size distribution is such that the scattering cross-section is dominated by small dust grains, while the mass is dominated by the largest particles. Submillimeter continuum radiation samples cometary particles much larger than those sampled by more common observations at shorter (optical and infrared) wavelengths and therefore provides a nearly direct measure of the cometary dust mass.

Author

Comets; Dust; Submillimeter Waves; Spectral Emission; Cometary Atmospheres; Comet Nuclei; Carbon Monoxide

19990025890 Colorado Univ., Center for Astro-Physics and Space Astronomy, Boulder, CO USA

Galaxy Cluster Masses at Moderate Redshifts ***Final Report***

Ellingson, E., Colorado Univ., USA; 1998; 1p; In English

Contract(s)/Grant(s): NAG5-4781

Report No.(s): CU-153-5836; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The masses of galaxy clusters are dominated by dark matter, and a robust determination of their masses has the potential of indicating how much dark matter exists on large scales in the universe, and the cosmological parameter Omega. X-ray observations of galaxy clusters provide a direct measure of both the gas mass in the intra-cluster medium, and also the total gravitating mass of the cluster. We used new and archival ROSAT observations to measure these quantities for a sample of intermediate redshift clusters which have also been subject to intensive dynamical studies, in order to compare the mass estimates from different methods. We used data from 14 of the CNOC cluster sample at 0.18 less than z less than 0.55 for this study. A direct comparison of dynamical mass estimates from Carlberg, Yee & Ellingson (1997) yielded surprisingly good results. The X-ray/dynamical mass ratios have a mean of 0.96+/- 0.10, indicating that for this sample, both methods are probably yielding very robust mass estimates. Comparison with mass estimates from gravitational lensing studies from the literature showed a small systematic with weak lensing estimates, and large discrepancies with strong lensing estimates. This latter is not surprising, given that these measurement

are made close to the central core, where optical and X-ray estimates are less certain, and where substructure and the effects of individual galaxies will be more pronounced. These results are presented in Lewis, Ellingson, Morris/Carlberg, 1998, submitted to the Astrophysical Journal. (Note that Lewis is Ellingson's Ph.D. thesis, who received direct support from this grant and is using this investigation as part of his thesis.) Three additional papers are in preparation. The first provides a comparison of the mass profiles as measured in X- rays and in galaxy dynamics. These profiles are difficult to determine for individual clusters, and are subject to asphericity and other individual quirks of each cluster. However, a composite profile for each method will allow us to test our assumptions of hydrostatic/dynamical equilibrium in the sample as a whole. A second paper provides a more detailed look at the cluster MS0906+11, which is a merging system. A third paper authord with J. Mohr at U. Chicago will invetigate the size-temoerature relationship for intermediate redshift clusters and its impications on cluster formation and cosmology. Future work on these data will include comparisons of the cluster galaxy populations and the extent of the intra-cluster medium, and a more homogeneous analysis of gravitational lensing.
Derived from text
Galactic Clusters; Mass Ratios; Red Shift; Galactic Mass; ROSAT Mission; Dark Matter

19990025893 Smithsonian Astrophysical Observatory, Cambridge, MA USA
US Gateway to SIMBAD Astronomical Database ***Annual Report, 1 Aug. 1997 - 31 Jul. 1998***
Eichhorn, G., Smithsonian Astrophysical Observatory, USA; September 1998; 3p; In English
Contract(s)/Grant(s): NAG5-32061
Report No.(s): NASA/CR-1998-208606; NAS 1.26:208606; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

During the last year the US SIMBAD Gateway Project continued to provide services like user registration to the US users of the SIMBAD database in France. User registration is required by the SIMBAD project in France. Currently, there are almost 3000 US users registered. We also provide user support by answering questions from users and handling requests for lost passwords. We have worked with the CDS SIMBAD project to provide access to the SIMBAD database to US users on an Internet address basis. This will allow most US users to access SIMBAD without having to enter passwords. This new system was installed in August, 1998. The SIMBAD mirror database at SAO is fully operational. We worked with the CDS to adapt it to our computer system. We implemented automatic updating procedures that update the database and password files daily. This mirror database provides much better access to the US astronomical community. We also supported a demonstration of the SIMBAD database at the meeting of the American Astronomical Society in January. We shipped computer equipment to the meeting and provided support for the demonstration activities at the SIMBAD booth. We continued to improve the cross-linking between the SIMBAD project and the Astro- physics Data System. This cross-linking between these systems is very much appreciated by the users of both the SIMBAD database and the ADS Abstract Service. The mirror of the SIMBAD database at SAO makes this connection faster for the US astronomers. The close cooperation between the CDS in Strasbourg and SAO, facilitated by this project, is an important part of the astronomy-wide digital library initiative called Urania. It has proven to be a model in how different data centers can collaborate and enhance the value of their products by linking with other data centers.
Derived from text
Astronomy; Data Bases; Information Systems; Data Systems; Computer Information Security

19990025897 Colorado Univ., Joint Inst. for Lab. Astrophysics, Boulder, CO USA
X-ray Variability Constraints on Compton Cloud Models of Cygnus X-1 ***Final Report***
Vaughan, Brian, Colorado Univ., USA; Jan. 26, 1999; 1p; In English
Contract(s)/Grant(s): NAG5-3310; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We have now completed this work, and all related publications have either appeared in print or are currently in press. A list of these publications is given below. There have been essentially three works that have arisen from this proposal. Spectral analysis of the data is presented in Dove et al. (1998a). Timing analysis is presented in Nowak et al. (1999a). Theoretical implications of the data analysis are discussed in Nowak et al. (1999b). Preliminary versions of all these works were presented at various conferences, and are reported in Nowak et al. (1997, 1998), Wilms et al. (1997), and Dove et al. (1998b). The grant was predominantly used for salary support for Dr. Michael Nowak, Dr. James Dove, and Dr. J. Wilms during the course of these projects. Grant funds were also used for Dr. Nowak to travel to Caltech to perform data analysis with Dr. Brian Vaughan, and for Dr. Wilms to visit JILA, University of Colorado, where much of this work was performed.
Author
X Rays; Variability; Cloud Cover; Models; Spectrum Analysis; Numerical Analysis

19990025930 Naval Research Lab., Washington, DC USA

Radar Studies of the Solar Corona: A Review of Experiments Using HF Wavelengths ***Interim Report***

Rodriguez, Paul; Jan. 29, 1999; 25p; In English

Report No.(s): AD-A359456; NRL/MR/6755--99-8313; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The use of high frequency (9 to 40 MHz), high power radars to study the solar corona has a remarkable history. Solar radar experiments were proposed and started at the beginning of the modern era of space physics research. Early in the 1960's the El Campo solar radar facility began routine operations. The published results from these pioneering experiments remain our largest resource of information on active probing of the solar corona. In 1969, solar radar experiments ceased even though experimental results suggested that significant diagnostics of the solar corona could be obtained with this technique. After the El Campo facility was decommissioned, a hiatus of about 25 years followed for further solar radar experiments. Recently, high frequency radar facilities in Russia and Ukraine have been used to conduct new solar radar experiments. The information that solar radars may provide is particularly relevant today, as we now recognize the important role of coronal mass ejections in geomagnetic disturbances. Solar radars offer the possibility of direct detection of earthward-moving coronal mass ejections, providing several days of advance warning to possible geomagnetic storms. In addition, investigations of wave scattering in the solar corona may provide information on coronal densities and irregularities. The techniques derived for studies of the earth's ionosphere using incoherent scatter radars are potentially applicable to the solar corona as well. We will review the early and current solar radar experiments and also discuss future directions for radar studies of the solar corona.

DTIC

Wave Propagation; Solar Corona; Radar Equipment; Atmospheric Physics; High Frequencies

19990025984 NASA Goddard Space Flight Center, Greenbelt, MD USA

A Three-Dimensional Analysis of the Galactic Gamma-Ray Emission Resulting from Cosmic-Ray Interaction with the Interstellar Gas and Radiation Fields ***Final Report, 15 Aug. 1997 - 15 Aug. 1998***

Sodraski, Thomas J., NASA Goddard Space Flight Center, USA; Dwek, Eli, NASA Goddard Space Flight Center, USA; August 1998; 5p; In English

Contract(s)/Grant(s): NASA Order S-92504-Z; NRA96-ADP-09; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This final report outlines the progress of the contractor's support for the analysis of data under ADP (NRA 96-ADP-08; Proposal No. 167-96 adp). The primary task object was to construct a 3-D model for the distribution of high-energy (20 MeV-30 GeV) gamma-ray emission in the Galactic disk. Under this task the contractor was to utilize data from the EGRET instrument on the Compton Gamma-Ray Observatory, HI and CO surveys, radio-continuum surveys at 408 MHz, 1420 MHz, 5 GHz, and 19 GHz, the COBE Diffuse Infrared Background Experiment (DIRBE) all-sky maps from I to 240 um, and ground-based B,V, J, H and K photometry. The respective contributions to the high-latitude gamma-ray emission from cosmic ray-matter interactions, inverse Compton scattering, and extra-galactic emission were to be determined.

Author

Gamma Rays; Three Dimensional Models; Galactic Cosmic Rays; Emission; Interstellar Gas; Data Processing; Electromagnetic Interactions; Radiation Distribution

19990026088 Lowell Observatory, Flagstaff, AZ USA

The Population of Small Comets: Optimum Techniques for Detection ***Final Report***

Schleicher, D., Lowell Observatory, USA; AHearn, M., Maryland Univ., USA; Stewart, I. A. F., Colorado Univ., USA; Randall, C., Colorado Univ., USA; Brandt, J., Colorado Univ., USA; Nov. 19, 1999; 2p; In English

Contract(s)/Grant(s): NGT5-4561; NAGw-4579; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The goals of this project were: (1) to present evidence to the scientific community for the importance of the small comet population and (2) to develop techniques for optimum detection in order to characterize the population. The work has been carried out by D. Schleicher (Lowell Observatory), M. A'Hearn and Y. Fernandez (University of Maryland), I.A.F. Stewart, C. Randall, and J. Brandt (University of Colorado).

Author

Comets; Populations; Procedures; Observation

19990026617 Aerospace Corp., Technology Operations, El Segundo, CA USA

Storm/Substorm Signatures in the Outer Radiation Belt

Korth, A.; Friedel, R. H.; Mouikis, C.; Fennell, J. F.; Jan. 15, 1999; 10p; In English; Prepared in cooperation with Max-Planck-Inst fuer Aeronomie, Lindau, Germany.

Contract(s)/Grant(s): F04701-93-C-0094

Report No.(s): AD-A359859; TR-98(85700)-5; SMC-TR-98-39; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The response of the ring current region is compared for periods of storm and substorm activity, with an attempt to isolate the contributions of both processes. We investigate CRRES particle data in an overview format that allows the display of long-term variations of the outer radiation belt. We compare the evolution of the ring current population to indicators of storm (Dst) and substorm (AE) activity and examine compositional changes. Substorm activity leads to the intensification of the ring current at higher L (L approx. 6) and lower ring current energies compared to storms (L approx. 4). The O(+)H(+) ratio during substorms remains low, near 10%, but is much enhanced during storms (can exceed 100%). We conclude that repeated substorms with an AE approx. 900 nT lead to a deltaDst of approx. 30 nT, but do not contribute to Dst during storm main phase as substorm injections do not form a symmetric ring current during such disturbed times.

DTIC

Outer Radiation Belt; Magnetic Storms; Magnetospheres

19990026641 New York Academy of Sciences, New York, NY USA

Nonlinear Dynamics and Chaos in Astrophysics: A Festschrift in Honor of George Contopoulos, Volume 867, Nonlinear Dynamics and Chaos in Astrophysics: A Fetschrift in Honor of George Contopoulos

Buchler, J. Robert, Editor, New York Academy of Sciences, USA; Gottesman, Stephen T., Editor, New York Academy of Sciences, USA; Kandrup, Henry E., Editor, New York Academy of Sciences, USA; Dec. 30, 1998; ISSN 0077-8923; In English; 13th; Nonlinear Astronomy, 12-14 Feb. 1998, Gainesville, FL, USA; Sponsored by Florida Univ., USA

Report No.(s): LC-98-51749; ISBN 1-57331-162-6; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The annals of the New York Academy of Sciences is a compilation of work in the area of nonlinear dynamics and chaos in Astrophysics. Sections included are: From Quasars to Extraordinary N-body Problems; Dynamical Spectra and the Onset of Chaos; Orbital Complexity, Short-Time Lyapunov Exponents, and Phase Space Transport in Time-Independent Hamiltonian Systems; Bifurcations of Periodic Orbits in Axisymmetric Scalefree Potentials; Irregular Period-Tripling Bifurcations in Axisymmetric Scalefree Potentials; Negative Energy Modes and Gravitational Instability of Interpenetrating Fluids; Invariants and Labels in Lie-Poisson Systems; From Jupiter's Great Red Spot to the Structure of Galaxies: Statistical Mechanics of Two-Dimensional Vortices and Stellar Systems; N-Body Simulations of Galaxies and Groups of Galaxies with the Marseille GRAPE Systems; On Nonlinear Dynamics of Three-Dimensional Astrophysical Disks; Satellites as Probes of the Masses of Spiral Galaxies; Chaos in the Centers of Galaxies; Counterrotating Galaxies and Accretion Disks; Global Spiral Patterns in Galaxies: Complexity and Simplicity; Candidates for Abundance Gradients at Intermediate Red-Shift Clusters; Scaling Regimes in the Distribution of Galaxies; Recent Progress in the Study of One-Dimensional Gravitating Systems; Modeling the Time Variability of Black Hole Candidates; Stellar Oscillons; Chaos in Cosmological Hamiltonians; and Phase Space Transport in Noisy Hamiltonian Systems.

CASI

Astrodynamics; Chaos; Nonlinear Systems; Dynamical Systems; Astrophysics

91
LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights. For spacecraft design or space stations see 18 Spacecraft Design, Testing and Performance.

19990025348 Ohio Aerospace Inst., Brook Park, OH USA

Instrumentation for Mars Environments *Final Report*

Landis, Geoffrey A., Ohio Aerospace Inst., USA; 1997; 2p; In English

Contract(s)/Grant(s): NAG3-1770; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The main portion of the project was to support the "MAE" experiment on the Mars Pathfinder mission and to design instrumentation for future space missions to measure dust deposition on Mars and to characterize the properties of the dust. A second

task was to analyze applications for photovoltaics in new space environments, and a final task was analysis of advanced applications for solar power, including planetary probes, photovoltaic system operation on Mars, and satellite solar power systems.
Author
Design Analysis; Mars Environment; Mars Pathfinder; Space Missions; High Temperature Environments; Photovoltaic Conversion; Satellite-Borne Instruments

19990025390 NASA Goddard Space Flight Center, Greenbelt, MD USA
Mars Secular Obliquity Change Due to Water Ice Caps
Rubincam, David P., NASA Goddard Space Flight Center, USA; 1998; 14p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Mars may have substantially changed its average axial tilt over geologic time due to the waxing and waning of water ice caps. Depending upon Mars' climate and internal structure, the average obliquity could have increased or decreased through climate friction by tens of degrees. A decrease could account for the apparent youthfulness of the polar layered terrain. Alternatively, Mars' average obliquity may have changed until it became "stuck" at its present value of 24.4 deg.
Author
Mars Environment; Ice; Secular Variations; Geochronology; Climate

19990025586 Butrica (Andrew J.), USA
Voyager: The Grand Tour of Big Science, Chapter 11
Butrica, Andrew J., Butrica (Andrew J.), USA; From Engineering Science to Big Science: The NACA and NASA Collier Trophy Research Project Winners; 1998, pp. 251-276; In English; ISBN 0-16-049640-3; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Of all the NASA missions, none has visited more planets, rings and satellites nor has provided as many fresh insights in to the outer planets as Voyager. The Voyager mission was extremely successful in gathering information about the outer planets. The mission also demonstrated that there is not a distinction between big science and little science. A single scientific enterprise exists in which both big and little sciences are woven together.
CASI
Voyager Project; Space Exploration; Space Missions

19990025765 Naval Postgraduate School, Monterey, CA USA
Modeling, Simulation and Visualization of Aerocapture
leszcynski, Zigmond V.; Dec. 1998; 108p; In English
Report No.(s): AD-A358932; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

A vehicle travelling from Earth to another planet on a ballistic trajectory approaches that planet at hyperbolic velocity. Upon arrival, the vehicle must significantly reduce its speed for orbit insertion. Traditionally, this deceleration has been achieved by propulsive capture, which consumes a large amount of propellant. Aerocapture offers a more fuel-efficient alternative by exploiting vehicular drag in the planet's atmosphere. However, this technique generates extreme heat, necessitating a special thermal protection shield (TPS). Performing a trade study between the propellant mass required for propulsive capture and the TPS mass required for aerocapture can help determine which method is more desirable for a particular mission. The research objective of this thesis was to analyze aerocapture dynamics for the advancement of this trade study process. The result was an aerocapture simulation tool (ACAPS) developed in MATLAB with SIMULINK, emphasizing code validation, upgradeability, user-friendliness and trajectory visualization. The current version, ACAPS 1.1, is a three- degrees-of-freedom point mass simulation model that incorporates a look-up table for the Mars atmosphere. ACAPS is expected to supplement the National Aeronautics and Space Administration (NASA) Jet Propulsion Laboratory (JPL) Project Design Center (PDC) toolkit as preliminary design software for the Mars 2005 Sample Return (MSR) Mission, Mars 2007 Mission, Mars Micromissions, Neptune/Triton Mission, and Human Mars Mission.
DTIC
Aerocapture; Ballistic Trajectories; Deceleration; Degrees of Freedom; Drag; Jet Propulsion; Laboratories; Mars Atmosphere

19990025822 Lunar and Planetary Inst., Houston, TX USA

HEDS-UP Mars Exploration Forum

Budden, Nancy Ann, Editor, Lunar and Planetary Inst., USA; Duke, Micheal B., Editor, Lunar and Planetary Inst., USA; 1998; 241p; In English; Mars Exploration, 4-5 May 1998, Houston, TX, USA; Sponsored by Lunar and Planetary Inst., USA; See also 19990025823 through 19990025839

Contract(s)/Grant(s): NASw-4574

Report No.(s): LPI-Contrib-955; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

In the early 1990s, Duke and Budden convened a series of workshops addressing mission rationale, exploration objectives, and key constraints and issues facing human crews on Mars. The focal point was ”why” the U.S. should fly humans to Mars. In the mid-1990s, strategies for a Mars mission matured and evolved, driven formally by NASA Johnson Space Center’s Office of Exploration. In 1997, NASA published a report capturing the current thinking: the NASA Mars Reference Mission. In the 1997-1998 school year, HEDS-UP sponsored six universities to conduct design studies on Mars exploration, using the Reference Mission as a basis for their work. The 1998 Mars Exploration Forum presents the results of these university studies, suggesting ”how” we might explore Mars, in terms of specific technical components that would enable human missions to Mars. A primary objective of the HEDS-UP Mars Exploration Forum was to provide a forum for active interaction among NASA, industry, and the university community on the subject of human missions to Mars. NASA scientists and engineers were asked to present the state of exploration for Mars mission options currently under study. This status ”snapshot” of current Mars strategies set the stage for the six HEDS-UP universities to present their final design study results. Finally, a panel of industry experts discussed readiness for human missions to Mars as it pertains to the aerospace industries and technologies. A robust poster session provided the backdrop for government-industry-university discussions and allowed for feedback to NASA on the Mars Reference Mission. The common thread woven through the two days was discussion of technologies, proven and emerging, that will be required to launch, land, and sustain human crews on the Red Planet. As this decade (and indeed this millenium) draws to a close, Mars will continue to loom in our sights as the next target for human space exploration. It is our hope that the efforts of the Mars Exploration Forum will serve as one small contribution toward the ultimate goal of humans exploring Mars.

Derived from text

Mars Exploration; Manned Mars Missions; Conferences; NASA Space Programs; Technology Assessment

19990025823 NASA Ames Research Center, Moffett Field, CA USA

Mars Human Exploration Objectives

Briggs, Geoff, NASA Ames Research Center, USA; HEDS-UP Mars Exploration Forum; 1998, pp. 41-46; In English; See also 19990025822; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

This paper reviews the objectives and other considerations of Human exploration of Mars. The objectives of human exploration of Mars are: (1) to learn how Mars is similar to, and different from, Earth; (2) to explore possible life, past and present; (3) to discover what Mars is like now from the perspective of Geoscience and geologic history; and (4) how did Mars form and how did its formation differ from Earth. Considerations of human Martian exploration involve: (1) having a capable base laboratory; (2) having long range transportation; (3) having operational autonomy of the crew, and the requirement of the crew to possess a range of new cognitive processes along with easy communications with terrestrial colleagues; and finally (4) creating the human habitat along with human factors which involve more than just survivability.

CASI

Human Factors Engineering; Mars (Planet); Mars Exploration; Manned Mars Missions; Exobiology; Extraterrestrial Life

19990025824 NASA Johnson Space Center, Houston, TX USA

Mars Human Exploration Reference Mission

Drake, Bret, NASA Johnson Space Center, USA; HEDS-UP Mars Exploration Forum; 1998, pp. 47-58; In English; See also 19990025822; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This presentation proposes the next steps for human exploration of Mars. The presentation reviews the reasons for human exploration of Mars. Two different trajectories are proposed: (1) for a long stay mission, and (2) for a short term mission, which could also include a swing by Venus. A reference mission scenario is investigated, which includes forward deployment of two cargo missions, followed by a human piloted mission. The power needs of such a mission include nuclear thermal propulsion, and the possible use of Mars in situ resources. The exploration will require electric propulsion, stationary power source, and a

mobile power source. The trajectories required for electric propulsion of earth are shown, and the engineering of a Mars Transportation Habitat are reviewed.
CASI
Electric Propulsion; Habitats; Mars Exploration; Nuclear Propulsion; Manned Mars Missions; Mars (Planet); Interplanetary Spacecraft; Earth-Mars Trajectories

19990025829 NASA Johnson Space Center, Houston, TX USA
In-Situ Resource Utilization (ISRU) Development Program
Sanders, Jerry, NASA Johnson Space Center, USA; HEDS-UP Mars Exploration Forum; 1998, pp. 89-94; In English; See also 19990025822; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The question "Why In-Situ Resource Utilization (ISRU)?" is addressed in this presentation. The reasons given concentrate on Cost reduction, Mass reduction, Risk reduction, the expansion of human exploration and presence and the enabling of industrial exploitation. A review of the Martian and Lunar resources available for ISRU is presented. Other ISRU concepts (i.e., In-Situ Consumable production (ISCP) and In-Situ Propellant Production (ISPP)) are introduced and further explained. The objectives of a Mars ISRU System Technology (MIST) include (1) the characterization of technology and subsystem performance for mission modeling and technology funding planning, (2) reduce risk and concerns arising from sample return and human missions utilizing ISRU, and (3) demonstrate the environmental suitability of ISRU components/processes and systems. A proof of concept demonstration schedule and a facility overview for MIST is presented.
CASI
Mars (Planet); Propellants; Manned Mars Missions; Mars Exploration; Mars Environment; Mars Surface; Environmental Engineering; Mars Bases; Extraterrestrial Resources

19990025830 NASA Marshall Space Flight Center, Huntsville, AL USA
Transportation: Destination Mars
Eoff, Bill, NASA Marshall Space Flight Center, USA; HEDS-UP Mars Exploration Forum; 1998, pp. 97-109; In English; See also 19990025822; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

As the agency space transportation lead center, Marshall Space Flight Center has been conducting transportation assessments for future robotic and human Mars missions to identify critical technologies. Five human Mars options are currently under assessment with each option including all transportation requirements from Earth to Mars and return. The primary difference for each option is the propulsion source from Earth to Mars. In case any of the options require heavy launch capability that is not currently projected as available, an in-house study has been initiated to determine the most cost effective means of providing such launch capability. This assessment is only considering launch architectures that support the overall human Mars mission cost goal of $25B. The guidelines for the launch capability study included delivery of 80 metric ton (176 KLB) payloads, 25 feet diameter x 92 feet long, to 220 nmi orbits at 28.5 degrees. The launch vehicle concept of the study was designated "Magnum" to differentiate from prior heavy launch vehicle assessments. This assessment along with the assessment of options for all transportation phases of a Mars mission are on-going.
Author
Cost Effectiveness; Launch Vehicles; Propulsion; Space Transportation; Manned Mars Missions; Solar Electric Propulsion; Aeroassist; Interplanetary Transfer Orbits; Cryogenic Fluids

19990025831 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Advanced Exploration Technologies: Micro and Nano Technologies Enabling Space Missions in the 21st Century
Krabach, Timothy, Jet Propulsion Lab., California Inst. of Tech., USA; HEDS-UP Mars Exploration Forum; 1998, pp. 111-121; In English; See also 19990025822; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Some of the many new and advanced exploration technologies which will enable space missions in the 21st century and specifically the Manned Mars Mission are explored in this presentation. Some of these are the system on a chip, the Computed-Tomography imaging Spectrometer, the digital camera on a chip, and other Micro Electro Mechanical Systems (MEMS) technology for space. Some of these MEMS are the silicon micromachined microgyroscope, a subliming solid micro-thruster, a micro-ion thruster, a silicon seismometer, a dewpoint microhygrometer, a micro laser doppler anemometer, and tunable diode laser (TDL) sensors. The advanced technology insertion is critical for NASA to decrease mass, volume, power and mission costs, and increase functionality, science potential and robustness.
CASI
Ion Engines; Manned Mars Missions; Micromachining; Spacecraft Propulsion; Microelectromechanical Systems; Technology Transfer; Technology Utilization; NASA Programs

19990025832 Space Mission Innovations, USA

Flag and Footprints Mission Mars: Preliminary Design Review Two

HEDS-UP Mars Exploration Forum; 1998, pp. 125-136; In English; See also 19990025822; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

SMI has developed a preliminary guideline for a flag and footprints manned mission to Mars. The manned mission is a split mission where the return and ground supplies will be sent on a cargo spacecraft. The crew spacecraft will leave on a high-energy trajectory once the cargo spacecraft has arrived in the prescribed orbit about Mars. The trajectory will be approximately 150-day from Low Earth Orbit (LEO) to the prescribed rendezvous orbit. The crew spacecraft will then dock with the orbiting cargo spacecraft for refuel and resupply. In addition, once safely docked, the crew members will transfer to the Mars Excursion Vehicle (MEV) for transport to the Martian surface. Each vehicle will be equipped with all necessary subsystems. to facilitate the transport of a large payload from Earth to Mars, the cargo spacecraft will utilize Ion propulsion. The Ion propulsion is ideal due to the high I(sub sp) characteristics. The crew spacecraft will be propelled with high-thrust RL-10 engines. Due to the smaller mass of the crew spacecraft, the spacecraft will utilize a 150-day high-energy trajectory. The MEV propulsion will be hypergolic. This choice of fuel is due to the reliability and simplicity of use. The crew members will stay on the surface of Mars for 30-days. During the 30-days, the crew will perform a series of scientific and exploratory experiments. to broaden the astronauts range of exploration, the astronauts will have access to three Unmanned Aerial Vehicles (UAV) and one rover while on the surface. The scientific experiments will consist of several soil and rock analyses as well as atmospheric study. Upon completion of the 30-day ground phase, the astronauts will return to the orbiting crew ship for return to Earth. SMI's flag and footprints mission outlines the fundamental systems and general requirements for these systems. SMI feels that with the fulfillment of these fundamental systems, this mission will be a highly desirable and potential candidate for development by NASA.

Author

Cargo Spacecraft; Ion Propulsion; Manned Mars Missions; Mars Surface; Propulsion; Rl-10 Engines; Supplying; Earth-Mars Trajectories; Rendezvous Spacecraft

19990025833 California Univ., Berkeley, CA USA

NASA Design Projects at UC Berkeley for NASA's HEDS-UP Program

Kuznetz, Lawrence, California Univ., USA; HEDS-UP Mars Exploration Forum; 1998, pp. 137-156; In English; See also 19990025822; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Missions to Mars have been a topic for study since the advent of the space age. But funding has been largely reserved for the unmanned probes such as Viking, Pathfinder and Global Surveyer. Financial and political constraints have relegated human missions, on the other hand, to backroom efforts such as the Space Exploration Initiative (SEI) of 1989-1990. With the new found enthusiasm from Pathfinder and the meteorite ALH84001, however, there is renewed interest in human exploration of Mars. This is manifest in the new Human Exploration and Development of Space (HEDS) program that NASA has recently initiated. This program, through its University Projects (HEDS-UP) office has taken the unusual step of soliciting creative solutions from universities. For its part in the HEDS-UP program, the University of California at Berkeley was asked to study the issues of Habitat design, Space Suits for Mars, Environmental Control and Life Support Systems, Countermeasures to Hypogravity and Crew Size/Mix. These topics were investigated as design projects in "Mars by 2012", an on-going class for undergraduates and graduate students. The methodology of study was deemed to be as important as the design projects themselves and for that we were asked to create an Interactive Design Environment. The Interactive Design Environment (IDE) is an electronic "office" that allows scientists and engineers, as well as other interested parties, to interact with and critique engineering designs as they progress. It usually takes the form of a website that creates a "virtual office" environment. That environment is a place where NASA and others can interact with and critique the university designs for potential inclusion in the Mars Design Reference Mission.

Derived from text

Crew Size; Environmental Control; Life Support Systems; Space Suits; Manned Mars Missions; Microgravity; Bioastronautics; Mars (Planet); Bioengineering; Spacecraft Environments

19990025835 Washington Univ., Dept. of Aeronautics and Astronautics, Seattle, WA USA

Extraction of Atmospheric Water on Mars for the Mars Reference Mission

Adan-Plaza, Sergio, Washington Univ., USA; Carpenter, Kirsten, Washington Univ., USA; Elias, Laila, Washington Univ., USA; Grover, Rob, Washington Univ., USA; Hilstad, Mark, Washington Univ., USA; Hoffman, Chris, Washington Univ., USA; Schneider, Matt, Washington Univ., USA; Bruckner, Adam, Washington Univ., USA; HEDS-UP Mars Exploration Forum; 1998, pp. 171-194; In English; See also 19990025822; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The University of Washington has designed an in situ resource utilization system to provide water to a life support system in the laboratory module of the NASA Reference Mission to Mars. This system, the Water Vapor Adsorption Reactor (WAVAR),

extracts water vapor from the Martian atmosphere by adsorption in a bed of type 3A zeolite molecular sieve. The zeolite 3A adsorbs the water vapor until nearly saturated and is then heated within a sealed chamber by microwave radiation to drive off the water for collection. The water vapor flows to a condenser where it freezes and is later liquefied for use in the life support system. In the NASA Reference Mission, water, methane, and oxygen are produced for life support and propulsion via the Sabatier/Electrolysis process from seed hydrogen brought from Earth and Martian atmospheric carbon dioxide. In order for the WAVAR system to be compatible with the NASA Reference Mission, its mass must be less than that of the seed hydrogen and cryogenic tanks apportioned for life support in the Sabatier/Electrolysis process. The WAVAR system is designed for atmospheric conditions observed by the Viking missions, which measured an average global atmospheric water vapor concentration of approx. 2 x 10(exp -6)kg/cubic meter. WAVAR performance is analyzed taking into consideration hourly and daily fluctuations in Martian ambient temperature and the corresponding effects on zeolite performance.
Author
Adsorption; Electrolysis; Life Support Systems; Mars Atmosphere; Water; Water Vapor; Zeolites; Manned Mars Missions

19990025836 Wichita State Univ., Wichita, KS USA
Mars Analytical Laboratory
Nagati, M. Gawad, Wichita State Univ., USA; Ale-Ibrahaim, Kordi, Wichita State Univ., USA; Bins, Llonda, Wichita State Univ., USA; Davis, Michael, Wichita State Univ., USA; Gamalo, Johnny, Wichita State Univ., USA; Johnson, Matt, Wichita State Univ., USA; May, Neal, Wichita State Univ., USA; Seneviratne, Waruna, Wichita State Univ., USA; Yurko, Aric, Wichita State Univ., USA; Yurko, Brenda, Wichita State Univ., USA; HEDS-UP Mars Exploration Forum; 1998, pp. 195-200; In English; See also 19990025822; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

As mankind continues to explore the solar system, planetary colonization may become an important goal. Permanently manned space stations, bases on the moon, and colonization of Mars will be important steps in this exploration. The colonization and exploration of Mars will be a particular challenge. As mankind one day attempts this colonization, knowledge of the Martian environment and human capacity to live there will become vitally important. The first scientific outposts on Mars will need research laboratories to make discoveries about how we can better live there and use the natural resources of the planet to sustain human life. The design of a laboratory for an existing Martian base is the purpose of this project. A laboratory on Mars would be very useful to the scientists we send.
Derived from text
Mars (Planet); Space Stations; Manned Mars Missions; Mars Bases; Laboratory Equipment; Space Laboratories; Pressure Vessels; Chemical Propulsion

19990025837 Maryland Univ., College Park, MD USA
MERLIN: Martian Exploratory Rover for Long-range INvestigation
Henriette, Jean-Marc, Maryland Univ., USA; Patel, Kevin, Maryland Univ., USA; Brenza, Michelle, Maryland Univ., USA; Gelchion, Donna, Maryland Univ., USA; Shaiou, Wei, Maryland Univ., USA; Potocko, Joshua, Maryland Univ., USA; Watkins, Christopher, Maryland Univ., USA; Marsh, Kevin, Maryland Univ., USA; Zuniga, Patricia, Maryland Univ., USA; Kothari, Kamini, Maryland Univ., USA; Stachel, Sofia, Maryland Univ., USA; Turner, Melissa, Maryland Univ., USA; Hughes, Lee, Maryland Univ., USA; Radcliff, E. Grant, Maryland Univ., USA; Akin, David, Maryland Univ., USA; Bowden, Mary, Maryland Univ., USA; Shook, Laurie, Maryland Univ., USA; HEDS-UP Mars Exploration Forum; 1998, pp. 201-222; In English; See also 19990025822; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

In the days of the Apollo program, it was recognized that it was necessary to cover as much of the surface of the Moon as possible in order to accurately portray the planet's geology. Due to the time and weight constraints of the program, the first few missions covered the surface on foot, with only the last three using battery-powered, unpressurized rovers. In the future, when mankind colonizes the other planets, the surface stay will be considerably longer, the weight allowances will be much greater, and the science to be performed will be expanded dramatically. All of these factors will cause serious consideration to be given to the idea of a pressurized rover for extended surface excursions. The following is one possible design for a pressurized rover for use on Mars. It was designed by University of Maryland, College Park Aerospace Engineering students in the second semester of their senior Space Systems Design class. The class was broken down into six groups in order to spread out the workload. The groups were the following: Avionics; Crew Systems; Mission Analysis; Power, Propulsion, and Thermal; Structures and Loads; and Systems Integration.
Author
Electric Batteries; Mars (Planet); Roving Vehicles; Mars Surface; Pressure Vessels; Life Support Systems; Robotics; Oxygen Supply Equipment; Space Habitats

19990025839 Lockheed Martin Astronautics, Denver, CO USA

An Innovative Technology for Mars Exploration

Henry, E. Michael, Lockheed Martin Astronautics, USA; HEDS-UP Mars Exploration Forum; 1998, pp. 229-231; In English; See also 19990025822; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

The human mission to Mars will require innovative technology advances in autonomous control, hazardous avoidance, habitats, environmental protection and in situ resource utilization. As an example of the technological advances which have been achieved this presentation reports on an optical pattern recognition system that has been developed which can perform ultrahigh throughput pattern recognition. This system can act as an automatic lesion detection system as well as various defense defense applications.

CASI

Mars Exploration; Manned Mars Missions; Optical Data Processing; Pattern Recognition

19990025894 Institute for Scientific Research, Lexington, MA USA

Theoretical Studies of Important Processes in Planetary and Comet Atmospheres ***Final Report, 1 Feb. 1995 - 31 Mar. 1998***

Guberman, Steven L., Institute for Scientific Research, USA; 1998; 4p; In English

Contract(s)/Grant(s): NAGw-1404; NAG5-4316; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Using theoretical quantum chemical calculations, I have successfully described the dissociative recombination (DR) of O2(+) leading to the excited S-1 state of atomic oxygen, the upper state of the well known green line emission. The process is described by O2(+) + e(-) yields O(S-1)) + O(D-1) (1) where e(-) is an electron and the product oxygen atoms are both excited. This process is important in the atmospheres of Venus, Mars and Earth. I have shown in prior calculations that only one repulsive potential curve of O2, f(sup l)Sigma(sub u, sup +) can generate O(S-1) from DR of the lowest vibrational levels of O2(+). However, in the prior results, the calculated quantum yield (i.e. the number of O(S-1) atoms produced for every two product atoms) from the O2(+) v = 0 level was smaller than the laboratory and atmospheric measurements by more than an order of magnitude. Including only direct recombination, the calculated quantum yield for O(S-1) is only 0.0016. In a calculation that accounts for both direct and indirect recombination, the quantum yield is 0.0012. The range of experimentally determined quantum yields is between 0.01 and 0.23. Because of this large difference between the theoretical and experimental quantum yields, it was thought for some time that the ionospheric and laboratory O2(+) must be vibrationally excited since for excited levels, theory gave quantum yields that are similar to experimental yields. It was also suggested that some other process was generating O(S-1) but none could be identified. Under current NASA support, I have found that reaction (1) proceeds via an unusual mechanism. The f(sup 1)Sigma(sub u, sup,+) state does not cross the ion between the turning points of the v = 0 level of the O2(+) ground state. The lack of a favorable crossing leads to a very small calculated DR rate coefficient. However, this mechanism assumes that initial electron capture must occur into the repulsive state that leads to)(S-1). Instead, I have found that initial electron capture occurs mostly into the B(sup 3)Sigma(sup u, sub -) state which crosses the ion between the turning points of the v = 0 ion level and has a large DR rate coefficient. The B state dissociates to O(D-1) and)(P-3). After capture, some of the flux is transferred to the f(sup 1)Sigma(sup u, sub +) state via symmetry mixed intermediate Rydberg states. The neutral Rydberg states are a mixture of Sigma(sub u, sup +)-1 and Sigma(sub u, sup -)-3 symmetry.

Derived from text

Numerical Analysis; Planetary Atmospheres; Cometary Atmospheres; Electron Capture

19990025913 Naval Postgraduate School, Monterey, CA USA

Mission Analysis for the Mars 2007 Opportunity

Zike, Stephen B.; Dec. 1998; 236p; In English

Report No.(s): AD-A359375; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

In 2007, NASA will launch an orbiter and a lander to Mars in support of science and exploration goals. NASA's Jet Propulsion Laboratory is responsible for the mission design. A trajectory analysis is necessary to ensure that the most cost-effective interplanetary transfer is implemented. This thesis presents a comprehensive analysis of all possible type 1, 2, 3, and 4 Earth-Mars trajectories with reasonable launch energy requirements as well as possible return trajectories to Earth for the case of a sample return. Launch periods were determined using the JPL programs MIDAS and CATO. The corresponding C3 requirements for each trajectory were then utilized to obtain the performance capabilities for the Delta II series, Atlas II series, and Ariane 4/5 launch vehicles. The injected mass derived from the performance data was subsequently used as the spacecraft design point. The goal of this analysis was to identify the trajectory type and orbiter capture scheme that produced the maximum post-capture orbiter mass. The advantages and disadvantages of propulsive capture, aerocapture, and aerobraking are addressed for numerous launch scenarios

in which the orbiter and lander are either launched on separate launch vehicles or on a single launch vehicle. This comparison was successful in demonstrating the impact of the orbiter capture scheme on the selection of the optimal trajectories.
DTIC
Launch Vehicles; Spacecraft; Trajectory Analysis; Aerobraking; Spacecraft Design

19990026217 Southwest Research Inst., San Antonio, TX USA
High-Resolution Spectroscopy of Auroras on Jupiter and Saturn/Earth Dayglow ***Final Report, 1 Feb. 1998 - 31 Jan. 1999***
Gladstone, G. Randall, Southwest Research Inst., USA; Feb. 03, 1999; 8p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG5-6767; SwRI Proj. 15-1668; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
The purpose of the grant was to allow the researcher to: (1) reduce and analyze Orbiting and Retrievable Far and Extreme Ultraviolet Spectrometers (ORFEUS) II observations of Jupiter (200s) and Saturn (1200s); (2) Reduce and analyze selected ORFEUS-II Earth Far Ultraviolet (FUV) airglow data; (3) Modify existing scripts for simulating Earth FUV airglow emissions to model a subset of the ORFEUS data.
Derived from text
Auroras; Dayglow; Far Ultraviolet Radiation; Jupiter (Planet); Saturn (Planet); Ultraviolet Astronomy

19990026220 Norwegian Defence Research Establishment, Kjeller, Norway
Proposal for a Cold Plasma Probe on the Mars Express Mission
Svenes, Knut, Norwegian Defence Research Establishment, Norway; Jun. 25, 1998; 61p; In English
Contract(s)/Grant(s): ESA-8989/88/NL/PB(SC); FFIE Proj. 752/172
Report No.(s): FFI/RAPPORT-98/02443; ISBN 82-464-0276-5; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
The focus of the Mars aeronomy Package is on characterizing the present morphology of the Martian exosphere. in particular, the determination of escape fluxes of the major species, as well as their spatial and temporal variations, are of paramount importance in this respect. Within this context the Cold Plasma Probe will have an important function in determining the ionospheric structure. The main purpose is that of characterizing the cold electron populations expected to be found in the vicinity of Mars. Several aspects of the Cold Plasma Probe makes it especially suited for that purpose. This report describes the background for the particular choices made in the design of the experiment. In addition, various predictions about the Martian plasma environment are also presented. The modelling principles employed are described in some detail.
Author
Cold Plasmas; Plasma Probes; Aeronomy; Mars (Planet); Spatial Distribution; Temporal Distribution

92
SOLAR PHYSICS

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

19990025193 Hughes STX, Inc., Lanham, MD USA
Identification of Solar Cycle 23 Minimum from Solar UV Measurements: NOAA-9 and NOAA-11 SBUV/2, UARS SUSIM, UARS Solstice
DeLand, Matthew T., Hughes STX, Inc., USA; Cebula, Richard P., Hughes STX, Inc., USA; 1997; 11p; In English; AGU, 12 Dec. 1997, San Francisco, CA, USA
Contract(s)/Grant(s): NASw-4864
Report No.(s): NASA/CR-1997-207711; NAS 1.26:207711; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The purpose of this report is to present results from the study of solar cycles from solar UV measurements from March 1985 to May 1997. The study determined solar minimum date from daily spectral irradiance data sensitive to noise and the means through which long-term calibration was obtained. In this study magnesium II time series was determined from NOAA-9, and UARS (Upper Atmosphere Research Satellite) SUMIM and SOLSTICE satellites.
CASI
Ultraviolet Radiation; Solar Cycles; Solar Spectra; Solar Radiation

19990025371 Lockheed Martin Missiles and Space, Advanced Technology Center, Palo Alto, CA USA
The Transport of Solar Ions Through the Earth's Magnetosphere ***Final Report, Period ending 31 Oct. 1998***
Lennartsson, O. W., Lockheed Martin Missiles and Space, USA; Jan. 29, 1999; 38p; In English
Contract(s)/Grant(s): NAGw-4177; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report covers the initial phase of an investigation that was originally selected by NASA Headquarters for funding by a grant but was later transferred to NASA GSFC for continued funding under a new and separate contract. The principal objective of the investigation, led by Dr. O.W. Lennartsson, is to extract information about the solar origin plasma in Earth's magnetosphere, specifically about the entry and transport of this plasma, using energetic (10 eV/e to 18 keV/e) ion composition data from the Lockheed Plasma Composition Experiment on the NASA/ESA International Sun-Earth Explorer One (ISEE 1) satellite. These data were acquired many years ago, from November 1977 through March of 1982, but, because of subsequent failures of similar experiments on several other spacecraft, they are still the only substantial ion composition data available from Earth's magnetotail, beyond 10 R(sub E), in the critically important sub-kev to keV energy range. All of the Lockheed data now exist in a compacted scientific format, suitable for large-scale statistical investigations, which has been archived both at Lockheed Martin in Palo Alto and at the National Space Science Data Center (NSSDC) in Greenbelt. The completion of the archiving, by processing the remaining half of the data, was made possible by separate funding through a temporary NASA program for data restoration and was given priority over the data analysis by a no-cost extension of the subject grant. by chance, the period of performance coincided with an international study of source and loss processes of magnetospheric plasma, sponsored by the International Space Science Institute (ISSI) in Bern, Switzerland, for which Dr. Lennartsson was invited to serve as one of 12 co-chairs. This study meshed well with the continued analysis of the NASA/Lockheed ISEE ion composition data and provided a natural forum for a broader discussion of the results from this unique experiment. What follows is arranged, for the most part, in the context of the ISSI project.
Author
Earth Magnetosphere; International Sun Earth Explorer 1; Space Plasmas; Plasmas (Physics); Explorer 1 Satellite; Plasma Composition; Ions

19990026189 Harvard-Smithsonian Center for Astrophysics, Cambridge, MA USA
Enhancement of Lasco C1, C2, and C3 Coronagraph Images ***Annual Report, 1 Feb. 1998 - 31 Jan. 1999***
Karovska, Margarita; Jan. 1999; 9p; In English
Contract(s)/Grant(s): N00014-97-1-GO23
Report No.(s): AD-A359690; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Large Angle Spectrometric Coronagraph (LASCO) on board SOHO provided unprecedented views of the solar corona since January 1996. This instrument contains three individual coronagraphs C1, C2, and C3, described in detail in Brueckner et al (1995). The C1 coronagraph acquires high resolution images (11" and higher) of the lower corona from 1.1 R to 3.0 R, thereby providing a close link to the disk observations of other instruments in the SOHO complement. The C2 and C3 images have lower resolution (23" and about 2' respectively), however they provide a unique view of the extended corona up to 32 R. During the past year we carried out a study of the morphology and dynamical evolution of various structures in the solar corona as observed by LASCO and EIT. In the following, we summarize the results of this studies.
DTIC
Solar Corona; Solar Observatories; Coronagraphs

19990026288 Department of Energy, Office of Energy Research, Washington, DC USA
Interference of solar-probe inherent atmosphere with in-situ observations
Hassanein, A., Department of Energy, USA; Alekseev, V. A., Department of Energy, USA; Konkashbaev, A. I., Department of Energy, USA; Konkashbaev, I. K., Department of Energy, USA; Nikandrov, L. B., Department of Energy, USA; Jan. 31, 1998; 14p; In English; 2nd; IAC 1997: International aerospace congress
Report No.(s): DE98-057789; ANL/TD/CP-95855; CONF-9708170; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The solar corona is the source of solar wind that leads to the existence of the heliosphere and plays a crucial role in solar terrestrial phenomena. A comprehensive understanding of these phenomena can be provided only by directly measuring ion and electron velocity distributions, plasma waves, and fluxes of energetic particles. The problem presented by the inherent atmosphere of a spacecraft moving in the vicinity of the sun (4--20)R(sub (circle-dot)) and its influence on in-situ measurements of the solar corona plasma is the key to the realization and success of any solar probe mission. Models are developed to study and evaluate the effect of the inherent atmosphere on the in-situ measurements of future solar probes.
NTIS
Solar Probes; Atmospheric Effects; Solar Activity

19990026466 Department of Energy, Office of Financial Management and Controller, Washington, DC USA

Influence of solar-probe inherent atmosphere on in-situ observations

Hassanein, A., Department of Energy, USA; Konkashbaev, A. I., Department of Energy, USA; Konkashbaev, I. K., Department of Energy, USA; Nikandrov, L. B., Department of Energy, USA; Dec. 31, 1998; 5p; In English; 25th; Controlled Fusion and Plasma Physics, USA

Report No.(s): DE98-057946; ANL/TD/CP-96899; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The solar corona is the source of the solar wind, which is responsible for the heliosphere and plays a crucial role in solar/terrestrial phenomena. A comprehensive understanding of these phenomena can be established only by directly measuring ion and electron velocity distributions, plasma waves, and fluxes of energetic particles near the sun. The problem resulting from the inherent atmosphere of a spacecraft moving in the vicinity of the sun and the influence of this atmosphere on in-situ measurements of the solar corona plasma is key to the realization and success of any solar probe mission. to evaluate the influence of the probe-inherent atmosphere on in-situ observations, the authors have developed comprehensive radiation hydrodynamic models. The physics of plasma/probe/vapor interaction are also being developed in a self-consistent model to predict the effect of probe inherent atmosphere on in-situ measurements of corona parameters during solar flares. Interaction of the ionized atmosphere with the ambient natural plasma will create a turbulent shock wave that can affect in-situ measurements and must be taken into account in designing the spacecraft and its scientific components.

NTIS

Solar Probes; Atmospheric Effects; In Situ Measurement; Plasma Probes; Solar Flares

93
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.

19990025232 Iowa Univ., Dept. of Physics and Astronomy, Iowa City, IA USA

Chorus Source Locations from VLF Poynting Flux Measurements with the Polar Spacecraft

LeDocq, M. J., Iowa Univ., USA; Gurnett, D. A., Iowa Univ., USA; Hospodarsky, G. B., Iowa Univ., USA; Geophysical Research Letters; Nov. 01, 1998; ISSN 0094-8276; Volume 25, No. 21, pp. 4063-4066; In English; Original contains color illustrations

Contract(s)/Grant(s): NAS5-30371

Report No.(s): Paper-GRL-199800071; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Previous studies have used indirect evidence to argue that whistler-mode chorus emissions are generated near the magnetic equator. In this paper a spatial survey of wave normals and Poynting vectors computed from three-component electric and magnetic field measurements is used to show that chorus is generated very close to the magnetic equator. One surprising result is that there are almost no chorus emissions propagating toward the magnetic equator, such as might be expected from high-latitude magnetospheric reflections. The absence of a reflected component indicates that the chorus is reabsorbed, probably by Landau damping, before returning to the magnetic equatorial plane.

Author

Very Low Frequencies; Magnetic Equator; Magnetic Fields; Electrical Measurement

19990025445 Iowa Univ., Dept. of Physics and Astronomy, Iowa City, IA USA

Second Harmonic Hectometric Radio Emission at Jupiter

Menietti, J. D., Iowa Univ., USA; Gurnett, D. A., Iowa Univ., USA; Groene, J. B., Iowa Univ., USA; Geophysical Research Letters; Dec. 15, 1998; ISSN 0094-8276; Volume 25, No. 24, pp. 4425-4428; In English; Original contains color illustrations

Contract(s)/Grant(s): JPL-958779

Report No.(s): Paper-1998GL900193; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Galileo has been in orbit around Jupiter since December 1995. The plasma wave instrument on board the spacecraft has occasionally detected a rotationally modulated attenuation band in the hectometric (HOM) emission that most likely is due to scattering of the radiation from density fluctuations along the Io L-shell. The occurrence of the attenuation band is likely to be dependent on Io activity and the presence of density scattering centers along the Io L-shell as well as the location of the source region. Some of the attenuation bands show clear indications of second harmonic emission. Without polarization measurements, it is difficult to place constraints on the local generation conditions based on the cyclotron maser instability, but the results imply that second

harmonic emission could be present in the decametric (DAM) radiation as well. A survey of the data has revealed about 30 examples of second harmonic HOM.
Author
Radio Emission; Jupiter (Planet); Harmonic Radiation; Extraterrestrial Radiation

19990025951 Columbia Univ., Depts. of Astronomy and Physics, New York, NY USA
The Bright Gamma-Ray Transient GRO J1838-0145: Multiwavelength Studies of X-Ray Novae ***Final Report, 1 Dec. 1996 - 30 Nov. 1997***
Tavani, Marco, Columbia Univ., USA; January 1999; 2p; In English
Contract(s)/Grant(s): NAG5-3798
Report No.(s): CAL-3072; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We completed the observational work regarding the bright gamma-ray transient GRO J1838-014 that might be a representative of a new class of gamma-ray sources in our Galaxy. A bright gamma-ray flare was detected by EGRET in June 1996. Its time variability (approx. weeks) and the absence of a clearly identified radio-loud (-approx. 1 Jy) blazar in its error box are crucial for our interpretation of GRO J1838-014 as an object different from gamma-ray blazars or isolated pulsars. We also observed the error box with ASCA and SAX pointings without identifying obvious candidate counterparts. The X-ray flux in quiescence, if any, is quite low, and canonical X-ray binary systems are also excluded. GRO J1838-014 is not the only non-blazar gamma-ray transients detected by EGRET in the Galactic plane. An analysis of CGRO Cycle 4 data is being completed in collaboration with R. Mukherjee and J. Mattox with the discussion of other interesting unidentified sources. Pulsars embedded in transient gaseous surroundings (maybe in binary systems) or compact objects in special systems are plausible candidates. A theoretical analysis is being developed. We also continued the study of Galactic X-ray novae, in particular of systems producing radio jets such as GRS 1915+10. The use of Green Bank Interferometer data (of which the MT is the chair of the executive committee) has been of great use to GRO and other satellite missions. We completed a study of X-ray/radio outbursts of GRS 1915+10 with BSAX and Ryle radiotelescope data and CGRO/BATSE simultaneous data. We also continued our theoretical work on gamma-ray bursts.
Derived from text
Gamma Ray Observatory; X Ray Binaries; Novae; Blazars; Galaxies

19990026012 Iowa Univ., Dept. of Physics and Astronomy, Iowa City, IA USA
Galileo Direction Finding of Jovian Radio Emissions
Menietti, J. D., Iowa Univ., USA; Gurnett, D. A., Iowa Univ., USA; Kurth, W. S., Iowa Univ., USA; Groene, J. B., Iowa Univ., USA; Granroth, L. J., Iowa Univ., USA; Journal of Geophysical Research; Aug. 30, 1998; ISSN 0148-0227; Volume 103, No. E9, pp. 30 Aug. 1998; In English; Original contains color illustrations
Contract(s)/Grant(s): JPL-958779
Report No.(s): Paper-97JE03555; Copyright; Avail: Issuing Activity), Hardcopy, Microfiche

The Galileo spacecraft, in orbit about Jupiter, has observed distinct spin modulation of plasma wave emissions near the Ganymede (G1 and G2) encounters in the frequency range from about 100 kHz to approximately 6 MHz. Assuming circularly polarized, transverse electromagnetic radiation, we have used the spin modulation of the sweep-frequency receivers of the electric dipole antenna over many spins to estimate the source location in the spin plane of the spacecraft. Hectometric (HOM) and decametric (DAM) emission is observed by Galileo as a general and continuous background with frequent bursts that last tens of minutes and can be separated by minutes or hours. We have analyzed HOM and DAM emissions observed near Jupiter just after the G1 and G2 encounters, including two HOM/DAM ”arc” signatures observed after the G2 encounter. These latter appear to be low-frequency extensions of DAM arcs, with source regions along either the Io or the Ganymede flux tube. While the uncertainties associated with the data analysis do not allow a precise source location, the HOM/DAM emission observed near the G1 and G2 encounters is consistent with a gyroresonant source region, but it is necessary to require refraction due to the Io torus to understand the results. to explain emission from apparent source regions above a gyroresonant source region, wave refraction from asymmetrics in the Io plasma torus that extend along magnetic field lines is postulated. Alternatively, if such torus density asymmetries do not exist, emission with sources above a gyroresonant source region would require another free-energy source such as energetic plasma beams in the presence of density gradients or temperature anisotropies.
Author
Plasma Waves; Galileo Spacecraft; Ganymede; Polarized Electromagnetic Radiation; Magnetic Flux; Io

19990026119 Columbia Univ., Depts. of Astronomy and Physics, New York, NY USA

Studying Absorption Line Feature in the Relativistic Jet Source GRS 1915+105 ***Final Report, 1 Mar. 1997 - 28 Feb. 1998***

Tavani, Marco, Columbia Univ., USA; December 1998; 2p; In English

Contract(s)/Grant(s): NAG5-4012

Report No.(s): CAL-3064; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The galactic superluminal source GRS 1915+105 is among the most interesting objects in our Galaxy. It is subject to erratic accretion instabilities with energization of relativistic jets producing X-ray, optical and radio emission. This source was observed by ASCA on Sept. 27, 1994, April 20, 1995, October 23, 1996 and April 25, 1997 as part of a long timescale investigation. We detected strong variability of the source, and in particular the existence of burst/dip structure in October 1996 and April 1997. Clear evidence of transient absorption features at 6.7, 7.0 and 8.0 keV was obtained for the first time in September 1994 and April 1995. Given the phenomenology of plasmoid energization and ejection, these transient spectral features might be produced by material entrained in the radio jets or in other high-velocity outflows. Our contribution to the interpretation is to incorporate these observations into a overall theoretical picture for GRS 1915+105 also taking into account other observations by XTE and BSAX. The emerging picture is complex. The central source is subject to (most likely) super-Eddington instabilities mediated by magnetic field build-up, reconnection and dissipation in the form of blobs that eventually leads to the formation of transient spectral features from the surrounding of the plasmoid emitting region. A comprehensive theoretical investigation is in progress.

Derived from text

Research; Absorption Spectra; Radio Jets (Astronomy); Plasmas (Physics); Magnetic Fields; Light Emission; Images; Galaxies

19990026120 Columbia Univ., Depts. of Astronomy and Physics, New York, NY USA

Search for Hard X-Ray Emission from Aquila X-1: High Energy Emission from Gamma-ray Radio Star 2CG 135+1/LSI 61 305 ***Final Report, 1 Oct. 1995 - 30 Sep. 1997***

Tavani, Marco, Columbia Univ., USA; December 1998; 3p; In English

Contract(s)/Grant(s): NAG5-2729

Report No.(s): CAL-3065; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Several investigations supported by these CCRO grant were completed or are close to completion. The study of EGRET data for the unidentified source 2CG 135+01 was very fruitful. We discovered transient gamma-ray emission by combining several data obtained since 1994 through 1997. It is the first time that time variable emission is established for this enigmatic source, and clearly an interpretation in terms of an isolated radio pulsar (Geminga-like) is disfavored now. Our preferred model is a Galactic source, probably an energetic pulsar (such as PSR129-63) in a binary system producing gamma-rays because of pulsar wind/mass outflow interaction. We also accumulated may data concerning the radio source LSI 61 303, the possible counterpart of 2CG 135+01. We show that a possible anti-correlation between radio and gamma-ray emission exists. This anticorrelation is evident only in the energy range above 100 MeV, as demonstrated by the lack of it obtained from OSSE data. If confirmed, this anti-correlation would prove to be very important for the interpretation of the hundreds of unidentified gamma-ray sources currently discovered by EGRET near the Galactic plane, and would point to a new class of sources in addition to AGNs and isolated pulsars. We also completed the analysis of several time variable gamma-ray sources near the Galactic plane, with the discussion of evidence for transient emission from 2EG J1813-12 and 2EG J1828+01. We completed several investigations regarding gamma-ray bursts (GRBs), including the study of the brightness distribution for different spectral/duration GRB sub-classes, an investigation of acceleration processes and their consequences for GRB afterglow emission [61, the application of the synchrotron shock model of GRBs to X-ray energies.

Derived from text

X Ray Irradiation; Radio Emission; Research; Data Management; Gamma Ray Observatory; Large Scale Integration

19990026121 Smithsonian Astrophysical Observatory, Cambridge, MA USA

The Soft X-Ray Emission Component of Spiral Galaxies ***Final Report, 15 Mar. 1992 - 14 Sep. 1998***

Fabbiano, Giuseppina, Smithsonian Astrophysical Observatory, USA; December 1998; 3p; In English

Contract(s)/Grant(s): NAG5-1937; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Work included the analysis of the HRJ observations of the Sombrero galaxy (Fabbiano and Juda) published in Ap.J. This paper discussed the discovery of a point-like x-ray source at the nucleus of the galaxy, which is suspected to host a massive black hole. More work was done on the analysis of the Observation of M94 in support of an AXAF proposal. We have also analyzed the M81 data by adding to our observation the entire set of the archival ROSAT data. We plan to write up the results for publication. Both

galaxies have nuclei optically similar to that of the Sombrero galaxy. The nucleus of M81 is a known x-ray source. The M94 data has revealed a point-like nuclear source superposed on more diffuse emission.
Derived from text
X Ray Sources; Emission; Spiral Galaxies; Point Sources; Observation

19990026137 Department of Energy, Washington, DC USA
EUV and x-ray emission of nonmagnetic cataclysmic variables
Mauche, C. W., Department of Energy, USA; Sep. 01, 1997; 11p; In English; 13th; Catacylsmic variables
Report No.(s): DE98-053720; UCRL-JC-128488; CONF-9706258; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Recent results are presented and discussed regarding the Extreme Ultraviolet (EUV) and X-ray emission of nonmagnetic cataclysmic variables. Emphasis is given to high accretion rate systems (novalike variables and dwarf novae in outburst), and to a number of apparent discrepancies between observations and the theory of the boundary layer between the accretion disk and the surface of the white dwarf. Discussed are EUV and X-ray light curves, dwarf nova oscillations, and spectra, with new and previously unpublished results on SS Cyg and OY Car.
NTIS
X Rays; Ultraviolet Emission; Cataclysmic Variables; Extreme Ultraviolet Radiation

19990026157 Louisiana State Univ., Baton Rouge, LA USA
A SPDS Node to Support the Systematic Interpretation of Cosmic Ray Data ***Final Report***
1997; 3p; In English
Contract(s)/Grant(s): NAG5-4154; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The purpose of this project was to establish and maintain a Space Physics Data System (SPDS) node that supports the analysis and interpretation of current and future galactic cosmic ray (GCR) measurements by (1) providing on-line databases relevant to GCR propagation studies; (2) providing other on-line services, such as anonymous FTP access, mail list service and pointers to e-mail address books, to support the cosmic ray community; (3) providing a mechanism for those in the community who might wish to submit similar contributions for public access; (4) maintaining the node to assure that the databases remain current; and (5) investigating other possibilities, such as CD-ROM, for public dissemination of the data products. Shortly after the original grant to support these activities was established at Louisiana State University a detailed study of alternate choices for the node hardware was initiated. The chosen hardware was an Apple Workgroup Server 9150/120 consisting of a 120 MHz PowerPC 601 processor, 32 MB of memory, two I GB disks and one 2 GB disk. This hardware was ordered and installed and has been operating reliably ever since. A preliminary version of the database server was available during the first year effort and was used as part of the very successful SPDS demonstration during the Rome, Italy International Cosmic Ray Conference. For this server version we were able to establish the html and anonymous FTP server software, develop a Web page structure which can be easily modified to include new items, provide an on-line database of charge changing total cross sections, include the cross section prediction software of Silberberg & Tsao as well as Webber, Kish and Schrier for download access, and provide an on-line bibliography of the cross section measurement references by the Transport Collaboration. The preliminary version of this SPDS Cosmic Ray node was examined by members of the C&H SPDS committee and returned comments were used to refine the implementation.
Derived from text
Cosmic Rays; Memory (Computers); Atmospheric Physics; Data Bases; Data Systems; Galactic Cosmic Rays

19990026530 Oxford Univ., Dept. of Physics and Astrophysics, Oxford UK
The Nature and Evolution of Classical Double Radio Sources from Complete Samples
Blundell, Katherine M., Oxford Univ., UK; Rawlings, Steve, Oxford Univ., UK; Willott, Chris J., Oxford Univ., UK; 1998; 50p; In English
Report No.(s): OUAST/98/17; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present a study of the trends in luminosity, linear size, spectral index, and redshift of classical double radio sources from three complete samples selected at successively fainter low radio-frequency flux-limits. We have been able to decouple the effects of the tight correlation between redshift and luminosity (inherent in any single flux-limited sample) which have hitherto hindered interpretation of the relationships between these four source properties. The major trends found are that: (1) spectral indices increase with linear size; (2) rest-frame spectral indices have a stronger dependence on luminosity than on redshift except at high (GHz) frequencies; and (3)that the linear sizes are smaller at higher redshifts. We reproduce the observed dependences in a model for radio sources (born throughout cosmic time according to a radio-source birth function) whose lobes are fed with a synchrotron-emitting population from compact hotspots, and which suffer inverse Compton, synchrotron and adiabatic expansion losses. The

magnetic energy density within each hotspot is proportional to the jet-power, and synchrotron losses suffered in the hotspot mean that the energy spectrum of the emitting particles fed to the lobes is governed by the jet-power. The axial ratios of radio sources in our model increase as the sources age, and axial ratios are higher in sources with higher jet-power. In simulating the basic observed dependences, we find that there is no need to invoke any systematic change in the environments of these objects with redshift if the consequences of imposing a survey flux-limit on our simulated datasets are properly included in the model. It is also necessary to include appropriate energy loss mechanisms (such as the effects of the cosmic microwave background and feeding the lobes from a compact hotspot) which cause decreasing luminosity through the life of a source. Although our study has broken the luminosity-redshift degeneracy, we present evidence that for such studies there is an unavoidable ”youth-redshift degeneracy”, even though radio sources are short-lived relative to the age of the Universe; it is imperative to take this into account in studies which seemingly reveal correlations of source properties with redshift such as the ”alignment effect”.
Author
Research; Luminosity; Radio Frequencies; Red Shift; Energy Spectra; Background Radiation

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19990025290 Aix-Marseille Univ., Marseille, France
Rarefied Gas Dynamics, Book of Abstracts, Volume 1, Oral Sessions
Jul. 30, 1998; 351p; In English; 21st, 26-31 Jul. 1998, Marseille, France
Contract(s)/Grant(s): F61708-98-W-0021
Report No.(s): AD-A358901; EOARD-CSP-98-1024; No Copyright; Avail: CASI; A16, Hardcopy; A03, Microfiche
The Final Proceedings for 21st International Symposium on Rarefied Gas Dynamics, 26 July 1998 - 31 July 1998. This is an interdisciplinary conference. Topics include Boltzman equation and kinetic theory; Mathematical methods and models; Flow in transitional and rarefied regimes; Numerical simulations of RGD flows; Instrumentation and diagnostics in RGD flows; Free jets and molecular beams; Elementary collisional processes; Transport and relaxation phenomena; Chemical processes; Shock waves; Low density plasmas and ionized gases; Gas-surface interactions; Molecular beams; Clusters; Aerosols; Phase change; Aerodynamics and aerothermochemistry of space vehicles; Industrial applications I (vacuum technology, thin film, microengines...); Industrial applications II (beams, jets, lasers, reactors...); Astrophysics; Environmental aspects.
DTIC
Conferences; Rarefied Gas Dynamics; Aerothermochemistry

19990025291 Aix-Marseille Univ., Marseille, France
Rarefied Gas Dynamics: Book of Abstracts, Volume 2, Poster Sessions
Jul. 30, 1998; 314p; In English; 21st, 26-31 Jul. 1998, Marseille, France
Contract(s)/Grant(s): F61708-98-W-0021
Report No.(s): AD-A358900; EOARD-CSP-98-1024; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche
The Final Proceedings for 21st International Symposium on Rarefied Gas Dynamics, 26 July 1998 - 31 July 1998. This is an interdisciplinary conference. Topics include Boltzman equation and kinetic theory; Mathematical methods and models; Flow in transitional and rarefied regimes; Numerical simulations of RGD flows; Instrumentation and diagnostics in RGD flows; Free jets and molecular beams; Elementary collisional processes; Transport and relaxation phenomena; Chemical processes; Shock waves; Low density plasmas and ionized gases; Gas-surface interactions; Molecular beams; Clusters; Aerosols; Phase change; Aerodynamics and aerothermochemistry of space vehicles; Industrial applications I (vacuum technology, thin film, microengines...); Industrial applications II (beams, jets, lasers, reactors...); Astrophysics; Environmental aspects.
DTIC
Aerothermochemistry; Astrophysics; Conferences; Rarefied Gas Dynamics

19990025377 Aix-Marseille Univ., Marseille, France
Rarefied Gas Dynamics: Book of Abstracts, Volume 3, Special Session; Molecular Beams
Jul. 30, 1998; 161p; In English; 21st, 26-31 Jul. 1998, Marseille, France
Contract(s)/Grant(s): F61708-98-W-0021
Report No.(s): AD-A358902; EOARD-CSP-98-1024; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche
The Final Proceedings for 21st International Symposium on Rarefied Gas Dynamics, 26 July 1998 - 31 July 1998. This is an interdisciplinary conference. Topics include Boltzman equation and kinetic theory; Mathematical methods and models; Flow

in transitional and rarefied regimes; Numerical simulations of RGD flows; Instrumentation and diagnostics in RGD flows; Free jets and molecular beams; Elementary collisional processes; Transport and relaxation phenomena; Chemical processes; Shock waves; Low density plasmas and ionized gases; Gas-surface interactions; Molecular beams; Clusters; Aerosols; Phase change; Aerodynamics and aerothermochemistry of space vehicles; Industrial applications I (vacuum technology, thin film, microengines...); Industrial applications II (beams, jets, lasers, reactors...); Astrophysics; Environmental aspects.
DTIC
Conferences; Rarefied Gas Dynamics; Molecular Beams

19990025638 Arizona State Univ., Dept. of History, Tempe, AZ USA
The Collier as Commemoration: The Project Mercury Astronauts and the Collier Trophy, Chapter 7
Warren-Findley, Jannelle, Arizona State Univ., USA; From Engineering Science to Big Science: The NACA and NASA Collier Trophy Research Project Winners; 1998, pp. 165-191; In English; ISBN 0-16-049640-3; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In October of 1963, the Collier award was received by the seven Astronauts of the National Aeronautics and Space Administration's Project Mercury. Three particular sets of questions emerged as a result of the author's review of the literature: (1) How did the political, economic, cultural and diplomatic competition of the Cold War affect American technological developments? (2) How were very different ways of organizing and interpreting data of various sorts melded into an agency and a program that relied for its success on a common approach and focus? (3) What were the roles of the astronauts and how did the public persona of each astronaut play out during Project Mercury?
CASI
Astronauts; Competition; Politics; Mercury Project; Histories; Awards

19990026158 NASA, Washington, DC USA
This New Ocean: A History of Project Mercury
Swenson, Loyd S., Jr., NASA, USA; Grimwood, James M., NASA, USA; Alexander, Charles C., NASA, USA; 1998; 699p; In English
Report No.(s): NASA/SP-1998-4201; NAS 1.21:4201; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche

When Congress created the National Aeronautics and Space Administration (NASA) in 1958, it charged NASA with the responsibility "to contribute materially to . . . the expansion of human knowledge of phenomena in the atmosphere and space" and "provide for the widest practicable and appropriate dissemination of information concerning its activities and the results thereof." NASA wisely interpreted this mandate to include responsibility for documenting the epochal progress of which it is the focus. The result has been the development of a historical program by NASA as unprecedented as the task of extending man's mobility beyond his planet. This volume is not only NASA's accounting of its obligation to disseminate information to our current generation of Americans. It also fulfills, as do all of NASA's future-oriented scientific-technological activities, the further obligation to document the present as the heritage of the future. The wide-ranging NASA history program includes chronicles of day-to-day space activities; specialized studies of particular fields within space science and technology; accounts of NASA's efforts in organization and management, where its innovations, while less known to the public than its more spectacular space shots, have also been of great significance; narratives of the growth and expansion of the space centers throughout the country, which represent in microcosm many aspects of NASA's total effort; program histories, tracing the successes- and failures- of the various projects that mark man's progress into the Space Age; and a history of NASA itself, incorporating in general terms the major problems and challenges, and the responses thereto, of our entire civilian space effort. The volume presented here is a program history, the first in a series telling of NASA's pioneering steps into the Space Age. It deals with the first American manned-spaceflight program: Project Mercury. Although some academicians might protest that this is "official" history, it is official only in the fact that it has been prepared and published with the support and cooperation of NASA. It is not "official" history in the sense of presenting a point of view supposedly that of NASA officialdom-if anyone could determine what the "point of view" of such a complex organism might be. Certainly, the authors were allowed to pursue their task with the fullest freedom and in accordance with the highest scholarly standards of the history profession.
Derived from text
Histories; Mercury Project; NASA Space Programs; Mercury Flights

19990026573 NASA, Washington, DC USA

Legislative Origins of the National Aeronautics and Space Act of 1958, Monograph No. 8

Logsdon, John M., Compiler, George Washington Univ., USA; 1992; 88p; In English; Oral History Workshop, 3 Apr. 1992, Washington, DC, USA; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

A transcript of a 1992 collective oral history with several individuals who helped to draft the Space Act in 1958 is presented. Contributors include: Paul G. Dembling, Willis H. Shapley, Eilene M. Galloway, Glen P. Wilson, George Reedy, H. Guyford Stever and George Siegel.

Derived from text

NASA Space Programs; Histories; Conferences

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