# Scientific and Technical Aerospace Reports

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National Aeronautics and Space Administration
**Langley Research Center**

**Scientific and Technical Information Program Office**

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

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# Table of Contents

## Subject Divisions

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


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


## Indexes

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


Subject Term Index
Personal Author Index


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# Subject Categories of the Division A. Aeronautics


## 01 Aeronautics (General) 1

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

## 02 Aerodynamics 1

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

## 03 Air Transportation and Safety 3

Includes passenger and cargo air transport operations; aircraft ground operations; flight safety and hazards; and aircraft accidents. Systems and hardware specific to ground operations of aircraft and to airport construction are covered in *09 Research and Support Facilities (Air)*. Air traffic control is covered in *04 Aircraft Communications and Navigation*. For related information see also *16 Space Transportation and Safety*; and *85 Technology Utilization and Surface Transportation*.

## 04 Aircraft Communications and Navigation 9

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

## 05 Aircraft Design, Testing and Performance 12

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

## 06 Avionics and Aircraft Instrumentation 14

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

## 07 Aircraft Propulsion and Power 15

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 16

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

### 09 Research and Support Facilities (Air) 17

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

## Subject Categories of the Division B. Astronautics

### 12 Astronautics (General) 19

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

### 15 Launch Vehicles and Launch Operations 21

Includes all classes of launch vehicles, launch/space vehicle systems, and boosters; and launch operations. For related information see also *18 Spacecraft Design, Testing, and Performance; and 20 Spacecraft Propulsion and Power.*

### 18 Spacecraft Design, Testing and Performance 22

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

### 20 Spacecraft Propulsion and Power 24

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

## Subject Categories of the Division C. Chemistry and Materials

### 23 Chemistry and Materials (General) 28

Includes general research topics related to the composition, properties, structure, and use of chemical compounds and materials as they relate to aircraft, launch vehicles, and spacecraft. For specific topics

in chemistry and materials see *categories 24 through 29*. For astrochemistry see category *90 Astrophysics*.


### 24 Composite Materials 32

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

### 25 Inorganic, Organic, and Physical Chemistry 36

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

### 26 Metals and Metallic Materials 40

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

### 27 Nonmetallic Materials 48

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 53

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

### 29 Space Processing 58

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


## Subject Categories of the Division D. Engineering


### 31 Engineering (General) 59

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

### 32 Communications and Radar 62

Includes radar; radio, wire, and optical communications; land and global communications; communications theory. For related information see also *04 Aircraft Communications and Navigation;* and *17 Space Communications, Spacecraft Communications, Command and Tracking;* for search and rescue see *03 Air Transportation and Safety,* and *16 Space Transportation and Safety.*

## 33 Electronics and Electrical Engineering 67

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

## 34 Fluid Mechanics and Thermodynamics 71

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

## 35 Instrumentation and Photography 76

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

## 36 Lasers and Masers 78

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

## 37 Mechanical Engineering 80

Includes mechanical devices and equipment; machine elements and processes. For cases where the application of a device or the host vehicle is emphasized see also the specific category where the application or vehicle is treated. For robotics see *63 Cybernetics, Artificial Intelligence, and Robotics*; and *54 Man/System Technology and Life Support*.

## 38 Quality Assurance and Reliability 84

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

## 39 Structural Mechanics 86

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

# Subject Categories of the Division E. Geosciences


## 42 Geosciences (General) 92

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

## 43 Earth Resources and Remote Sensing 104

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

## 44 Energy Production and Conversion 106

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

## 45 Environment Pollution 116

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

## 46 Geophysics 132

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

## 47 Meteorology and Climatology 136

Includes weather observation forecasting and modification.

## 48 Oceanography 141

Includes the physical, chemical and biological aspects of oceans and seas; ocean dynamics, and marine resources. For related information see also *43 Earth Resources and Remote Sensing*.


# Subject Categories of the Division F. Life Sciences


## 51 Life Sciences (General) 142

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

### 52 Aerospace Medicine 171

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

### 53 Behavioral Sciences 175

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

### 54 Man/System Technology and Life Support 176

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


## Subject Categories of the Division G. Mathematical and Computer Sciences


### 59 Mathematical and Computer Sciences (General) 179

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

### 60 Computer Operations and Hardware 180

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

### 61 Computer Programming and Software 181

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

### 62 Computer Systems 191

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

### 63 Cybernetics, Artificial Intelligence and Robotics 194

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

### 64 Numerical Analysis 197

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

**65 Statistics and Probability 200**

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

**66 Systems Analysis and Operations Research 200**

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

**67 Theoretical Mathematics 202**

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

## Subject Categories of the Division H. Physics

**70 Physics (General) 202**

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

**71 Acoustics 205**

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

**72 Atomic and Molecular Physics 207**

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

**73 Nuclear Physics 210**

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

**74 Optics 215**

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

**75 Plasma Physics 222**

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

**76 Solid-State Physics 228**

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

## Subject Categories of the Division I. Social and Information Sciences


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

**81 Administration and Management** 234

Includes management planning and research.

**82 Documentation and Information Science** 237

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

**84 Law, Political Science and Space Policy** 245

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

**85 Technology Utilization and Surface Transportation** 245

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


## Subject Categories of the Division J. Space Sciences


**89 Astronomy** 246

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

**90 Astrophysics** 250

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

**91 Lunar and Planetary Science and Exploration** 255

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

**92 Solar Physics** 257

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

## 93 Space Radiation 258

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

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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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# SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

*A Biweekly Publication of the National Aeronautics and Space Administration*

VOLUME 40, SEPTEMBER 6, 2002

## 01
## AERONAUTICS (GENERAL)

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

**20020065470** Library of Congress, Federal Research Div., Washington, DC USA

**Wilbur and Orville Wright: A Bibliography Commemorating the One-Hundredth Anniversary of the First Powered Flight, December 17, 1903**

Renstrom, Arthur G., Compiler, Library of Congress, USA; Goldblatt, Roberta W.; Minkus, Carl; Berube, Karen L.; September 2002; 454p; In English

Report No.(s): NASA/SP-2002-4527/REV; NAS 1.21:4527/REV; LC-2002-072663; No Copyright; Avail: CASI; A20, Hardcopy; A04, Microfiche

This annotated bibliography of material about Wilbur and Orville Wright and the first powered flight, commemorates the one hundredth anniversary of the event. This publication represents an updated version of the classic, "Wilbur and Orville Wright: A Bibliography Commemorating the Hundredth Anniversary of the Birth of Wilbur Wright, April 16, 1867" which was originally published in 1968. Aspects of the Wright brothers' lives covered include: their published writings, biographical references, airplanes used and flight records, airplane components, patents, court records, Wright companies and schools, the Wright-Smithsonian controversy, monuments and museums, memorials, medals and honors, memorabilia, art, poetry, music, motion pictures and juvenile publications. An index is included.

CASI

*Bibliographies; Biography; Aircraft Pilots*

## 02
## AERODYNAMICS

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

**20020065457** Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Victoria, Australia

**An Auxiliary Interface Instrumentation Module for the AMRL Low Speed Wind Tunnel Data Acquisition System**

Bird, F. J.; Oct. 2001; 24p; In English; Original contains color images

Report No.(s): AD-A403643; DSTO-TR-1215; DODA-AR-012-026; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An IBM PC based electronic module is described which extends the capability of the data acquisition system of the Low Speed Wind Tunnel (LSWT) at the Aeronautical and Maritime Research Laboratory (AMRL). Occasions arise when wind tunnel measurements require external data input or specific data extraction by external or temporarily acquired equipment. Access to the data is provided by the Auxiliary Data Module (ADM). The ADM is one of the VME modules in the LSWT instrumentation console. The functions of two types of plug-in commercial board are used to provide a suite of digital input and output functions using a total of three boards. Two input, two output and two tachometer channels are provided by two identical I/O boards in

addition to the two standard PC RS-232C serial communication ports. The second plug-in board type provides eight analog input channels and two analog output channels with 12 bit resolution.
DTIC
*Wind Tunnel Tests; Tachometers; Consoles*

**20020065579** Lockheed Martin Aeronautical Systems, Marietta, GA USA
**A Multi-Disciplinary Assessment of the Hydrofoil Concept for Fast Ships** ***Final Report, Sep. 1999-Jun. 2002***
Berry, Owen; Coopersmith, Bob; Goodwin, Sabine; Gray, Burton; Layton, Jeff; Jun. 26, 2002; 587p; In English
Contract(s)/Grant(s): N00014-99-3-0010
Report No.(s): AD-A403618; No Copyright; Avail: CASI; A25, Hardcopy; A06, Microfiche
A multi-disciplinary analysis design analysis determining the feasibility and practicability of long-range high speed ships of varied design philosophy is presented. A hydrofoil ship is a dynamic lift vehicle that does not depend upon buoyancy for lift during cruise; as such, it presents an aircraft-like design problem. The small waterplane area (SWA) ship depends on static lift or buoyancy. The sizing and synthesis problem is first bounded using basic principles and linear theory. These equations are used to develop an understanding of the effect of the primary variables upon vehicle performance.
DTIC
*Drag Reduction; Hydrofoils*

**20020066415** Lawrence Livermore National Lab., Livermore, CA USA
**Multi-Year Program Plan for the Aerodynamic Design of Heavy Vehicles**
2002; 22p; In English
Report No.(s): DE2002-771203; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The goal of the proposed activities is to develop and demonstrate the ability to simulate and analyze aerodynamic flow around heavy truck vehicles using existing and advanced computational fluid dynamics (CFD) tools. The final products are validated CFD tools that can be used to reduce aerodynamic drag of heavy truck vehicles and thus improve their fuel efficiency. The project is divided into two related and overlapping efforts: Advanced Computations and Experiments of Benchmark Geometries Evaluation of Current and New Technologies. Each effort has near-term deliverables as well as longer-term goals. The computations and experiments will provide rapid results for simple benchmark geometries, and will advance to more complex geometries. The evaluation of current and new technologies will provide continued assessment for promising emerging technology.
NTIS
*Computational Fluid Dynamics; Trucks; Aerodynamic Drag; Drag Reduction*

**20020066507** Wyle Labs., Inc., Arlington, VA USA
**Measurements of Sonic Booms Due to ACM Training in the Elgin MOA Subsection of the Nellis Range Complex** ***Interim Report, Jan. 1987-Apr. 1993***
Frampton, Kenneth D.; Elmer, Kevin; Lucas, Michael J.; Plotkin, Kenneth J.; Apr. 1993; 117p; In English
Contract(s)/Grant(s): NAS1-19060; Proj-7757
Report No.(s): AD-A399778; WR-93-5; AFRL-HE-WP-TR-2002-0012; No Copyright; Avail: CASI; A02, Microfiche; A06, Hardcopy
The Elgin MOA is a subsection of the Nellis Range Complex located in southern Nevada. This airspace is regularly used for air combat maneuver (ACM) training which involves occasional supersonic flight. A sonic boom measurement program was conducted during the period from 25 March through 30 September 1992. The primary purpose of the measurement program was to obtain data suitable for the assessment of the sonic boom noise environment within the Elgin MOA. A secondary purpose of the program was to further refine current sonic boom noise environment prediction models. The sonic boom monitoring program described in this report was similar to the WSMR project in that monitors were distributed throughout the Elgin MOA over a six-month period. However, as in the R-2301E monitoring program, all of the monitors were BEARs. Data were also collected from all Air Combat Maneuver Instrumentation (ACMI) equipped flights in the Elgin MOA over the measurement period. This report contains a description of the Elgin MOA and the corresponding ACM operations in Section 2. The test plan including monitoring locations, operations data, and ACMI data are described in Section 3. Execution of the measurement program is described in Section 4, and the analysis of the collected data is described in Section 5. Finally, an updated model of the Lcdn) contours associated with sonic booms resulting from ACM operations is presented in Section 6.
DTIC
*Sonic Booms; Aircraft Maneuvers; Noise Measurement; Noise Prediction (Aircraft)*

**20020066785** NASA Ames Research Center, Moffett Field, CA USA

**Improving the Unsteady Aerodynamic Performance of Transonic Turbines using Neural Networks**

Rai, Man Mohan, NASA Ames Research Center, USA; Madavan, Nateri K., NASA Ames Research Center, USA; Huber, Frank W., Riverbend Design Services, USA; September 1999; 26p; In English

Contract(s)/Grant(s): RTOP 632-30-00

Report No.(s): NASA/TM-1999-208791; NAS 1.15:208791; A-99V0041; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A recently developed neural net-based aerodynamic design procedure is used in the redesign of a transonic turbine stage to improve its unsteady aerodynamic performance. The redesign procedure used incorporates the advantages of both traditional response surface methodology and neural networks by employing a strategy called parameter-based partitioning of the design space. Starting from the reference design, a sequence of response surfaces based on both neural networks and polynomial fits are constructed to traverse the design space in search of an optimal solution that exhibits improved unsteady performance. The procedure combines the power of neural networks and the economy of low-order polynomials (in terms of number of simulations required and network training requirements). A time-accurate, two-dimensional, Navier-Stokes solver is used to evaluate the various intermediate designs and provide inputs to the optimization procedure. The procedure yielded a modified design that improves the aerodynamic performance through small changes to the reference design geometry. These results demonstrate the capabilities of the neural net-based design procedure, and also show the advantages of including high-fidelity unsteady simulations that capture the relevant flow physics in the design optimization process.

Author

*Aerodynamic Characteristics; Supersonic Turbines; Design Optimization; Fluid Dynamics*

## 03
## AIR TRANSPORTATION AND SAFETY

*Includes passenger and cargo air transport operations; aircraft ground operations; flight safety and hazards; and aircraft accidents. Systems and hardware specific to ground operations of aircraft and to airport construction are covered in 09 Research and Support Facilities (Air). Air traffic control is covered in 04 Aircraft Communications and Navigation. For related information see also 16 Space Transportation and Safety; and 85 Technology Utilization and Surface Transportation.*

**20020065279** General Accounting Office, Washington, DC USA

**Air Traffic Control: FAA Needs to Better Prepare for Impending Wave of Controller Attrition**

Jun. 2002; 74p; In English

Report No.(s): PB2002-107607; GAO-02-591; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The Federal Aviation Administration (FAA) is responsible for managing the nations air transportation system so that the 200,000 aircraft taking off and landing each day can safely and efficiently carry more than 700 million passengers per year. Because of the significant hiring in the early 1980s to replace strikers who had been fired, many thousands of FAAs controllers will soon become eligible to retire, potentially leaving FAA with too few fully trained controllers. Because of these concerns, the chairman and ranking democratic member of the Subcommittee on Aviation, House Committee on Transportation and Infrastructure, asked GAO to: (1) identify likely future attrition scenarios for FAAs controller workforce and (2) examine FAAs strategy for responding to its short- and long-term staffing needs, including how it plans to address the challenges it may face. to identify likely future attrition scenarios, we: (1) reviewed FAAs 10-year hiring plan and associated attrition forecasts for approximately 15,000 controller specialists who actively control and separate traffic in the air and on the ground; (2) analyzed FAAs workforce database to determine when the current controllers (those at FAA as of June 30, 2001) would become eligible to retire; (3) developed a computer model to predict future attrition based on historic levels; and (4) developed and administered a survey to a statistically representative sample of controllers so as to obtain information on when they might leave FAA.1 GAOs analysis covers over 20,000 controllers the 15,000 controller specialists whom FAA analyzed, plus about 5,000 controllers who supervise and manage the air traffic control system.

NTIS

*Air Traffic Controllers (Personnel); Air Traffic; Air Transportation; Computerized Simulation; Data Bases; Forecasting*

**20020065283** Civil Aerospace Medical Inst., Oklahoma City, OK USA

**Relationship of Employee Attitudes and Supervisor-Controller Ratio to En Route Operational Error Rates** ***Final Report***

Broach, D. M.; Dollar, C. S.; May 2002; 18p; In English

Report No.(s): PB2002-107799; DOT/FAA/AM-02/9; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

An operational error (OE) results when an air traffic control specialist (ATCS) fails to maintain appropriate separation between aircraft, obstacles, etc. Recent research on OEs has focused on situational and individual characteristics (Center for Naval Analyses Corporation, 1995; Della Rocco, 1999; Rodgers, Mogford, Mogford, 1998). In this study, the relationship of organizational factors to en route OE rates was investigated, based on an adaptation of the Human Factors Analysis and Classification System (HFACS; Shappell & Wiegmann, 2000) to air traffic control as HFACS-ATC (Scarborough & Pounds, 2001). OE rates (errors per 100,000 operations) for 1997 and 2000 were obtained from the National Airspace Incident Monitoring System (NAIMS) for 21 air route traffic control centers (ARTCC). Organizational factors were represented by facility mean scores on scales constructed from 1997 and 2000 FAA Employee Attitude Survey (EAS) data. Factors included employee perceptions of equipment/facilities, performance management, overall job satisfaction, and perceptions of other human resources management practices. The supervisor-controller ratio (SCR) was calculated for each ARTCC by year from agency personnel data.
NTIS
*Air Traffic Control; Air Traffic Controllers (Personnel); Error Analysis; Resources Management*

**20020065330** General Accounting Office, Washington, DC USA
**Information Concerning the Arming of Commercial Pilots**
Jun. 28, 2002; 14p; In English
Report No.(s): AD-A403415; GAO-02-822R; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Since the terrorist attacks on September 11, 2001, legislation has been enacted to enhance the nation's approach to aviation security. Specifically, the Aviation and Transportation Security Act created the Transportation Security Administration (TSA) and, among other actions, federalized passenger and baggage screening staff at airports and authorized the arming of commercial pilots, subject to the approval of the Under Secretary of Transportation for Security and other conditions. On May 21, 2002, the Under Secretary testified that he would not approve the arming of commercial pilots because he believed they must focus exclusively on flying the aircraft. However, the question of arming pilots remains open because H.R. 4635, introduced on May 1, 2002, would require TSA to establish a program to arm pilots within 90 days of the bill's enactment. On June 19, 2002, the House Transportation and Infrastructure's Subcommittee on Aviation passed an amended version of H.R. 4635 to limit the maximum number of pilots participating in this pilot program to 2 percent of the total number of pilots employed by air carriers and require that TSA address a number of procedural issues before beginning the selection, training, and deputizing of pilots. In addition, four other bills, introduced before the Aviation and Transportation Security Act's enactment, include proposals to carry weapons.
DTIC
*Pilot Training; Air Transportation; Security*

**20020065364** Civil Aerospace Medical Inst., Oklahoma City, OK USA
**Contact Lens Use in the Civil Airman Population** ***Final Report***
Nakagawara, V. B.; Wood, K. J.; Montgomery, R. W.; May 2002; 18p; In English
Report No.(s): PB2002-107796; DOT/FAA/AM-02/6; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy
Since 1976, the use of contact lenses by civilian pilots has been permitted to correct distant vision for obtaining a Federal Aviation Administration (FAA) aeromedical certificate. Although contact lens technology has advanced dramatically in recent years, the aviation environment may still have adverse effects on contact lens performance in some flight situations. This study examined the civil airman population's experience with contact lens use for a 30-year period (1967-97). The information will help guide future medical certification decisions, policy revisions, and education safety programs for aeromedical and flight crew personnel. The FAA's Aerospace Medical Certification Division provided population totals for 1 January 1967 through 31 December 1997 of airmen who carried a pathology code for contact lens use (code 161) or orthokeratology (code 158). These data were stratified by class of medical certificate and age. Prevalence rates were calculated using the population frequencies from the annual Aeromedical Certification Statistical Handbook (AC 8500-1). A search of the National Transportation Safety Board (NTSB) and FAA databases was performed to determine if contact lens use had contributed to any aviation mishaps (accidents or incidents).
NTIS
*Civil Aviation; Contact Lenses; Aircraft Pilots; Aerospace Medicine*

**20020065369** General Accounting Office, Washington, DC USA

**National Airspace System: FAA's Approach to Its New Communications System Appears Prudent, but Challenges Remain**

Jul. 2002; 32p; In English

Report No.(s): PB2002-108121; GAO-02-710; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The Federal Aviation Administration (FAA) uses radios to provide air ground voice and data communications for pilots and air traffic controllers to safely coordinate all flight operations-ground movements of aircraft at airports, take-offs and landings, and separation distances between aircraft as they cruise at high altitudes. However, the anticipated growth in air traffic, coupled with FAA's efforts to reduce air traffic delays and introduce new air traffic services, will create a demand for additional channels for voice communications that FAA's current system cannot provide. FAA is implementing a new communications system to respond to this challenge and also seeking to enhance its existing ability to transmit data to provide more information to pilots, reduce errors in voice communications, and better balance controllers' workload. Moreover, FAA expects that its new system should be less susceptible to interference from such sources as power lines and radio and television stations and also improve security against unauthorized users. FAA is developing products to use with its future integrated voice and data communications system. FAA refers to the initiative to acquire this system as Next Generation Air/Ground Communications (NEXCOM) and estimates that its long-term funding commitment for this initiative could reach $4 billion through fiscal year 2023. Because voice and data communications are critical to air traffic management, you asked us to determine (1) to what extent the existing voice and data communications system used by FAA can effectively meet its expected future needs, (2) what FAA has done to help ensure that the technology it wants to use for NEXCOM will meet its future needs, and (3) what major issues FAA needs to resolve before it can make a final decision on the technology it wants to use for NEXCOM. to address these objectives, among other things, we interviewed and analyzed data and documentation from FAA program officials, experts in communications from the Department of Defense and the National Aeronautics and Space Administration, representatives of national and international aviation groups, and officials representing FAA's controller and maintenance workforces. We did not verify the data FAA provided or the results of FAA's analysis.

NTIS

*Communication; Air Traffic Control; Data Acquisition; Flight Operations*

**20020065533** Harris (F. D.) and Associates, Fountain Hills, AZ USA

**U.S. Civil Rotorcraft Accidents, 1963 through 1997**

Harris, Franklin D., Harris (F. D.) and Associates, USA; Kasper, Eugene F., Army Aviation and Missile Command, USA; [1998]; 1p; In English; American Helicopter Society Forum 55, 25-27 May 1999, Montreal, Canada; Sponsored by American Helicopter Society, Inc., USA

Contract(s)/Grant(s): NCC2-829; No Copyright; Avail: Issuing Activity; Abstract Only

The U.S. National Transportation Safety Board (NTSB) has recorded 8,436 rotorcraft accidents during the period mid - 1963 through the end of 1997. Review and analysis of the NTSB summary narrative for each accident has been completed. In addition, FAA (Federal Aviation Administration) counts of the growing registered rotorcraft fleet over this period has obtained. Taken together, a large and informative data base is now available, which indicates that the accident rate (on a per airframe basis) has changed very little since the mid 1970s. The data base, even in the summary form provided by this paper, offers suggestions for safer designs and improved flight operations. For analysis purposes, each accident has been placed in one of 21 top level categories as defined by the NTSB. Analysis of this grouping shows that 70 percent of rotorcraft accidents are associated with four categories. The accident count in these top four categories are: (1) 2,408 Loss of engine power (2) 1,322 In flight collision with object (3) 1,114 Loss of control (4) 1,083 Airframe/component/system failure or malfunction. Single engine rotorcraft dominate these accident statistics because of their sheer numbers over the study period. One-third of the loss of engine power accidents with these aircraft is fuel/air mixture related and fuel exhaustion is a common event. This appears to be the case whether a piston or turbine engine is installed. This paper provides similar study results in the other major mishap categories. It shows that both minor and major design and flight operations changes can -- and should -- be made to reduce rotorcraft accidents in the future. The paper outlines these changes and suggests how they may be made.

Author

*Aircraft Accident Investigation; Rotary Wing Aircraft; Statistical Analysis*

**20020066162** NASA, Washington, DC USA

**”We Freeze to Please”: A History of NASA’s Icing Research Tunnel and the Quest for Flight Safety**

Leary, William M., Georgia Univ., USA; 2002; 221p; In English

Report No.(s): NASA/SP-2002-4226; NAS 1.21:4226; LC-2002-025511; ISBN 0-16-067434-4; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

The formation of ice on wings and other control surfaces of airplanes is one of the oldest and most vexing problems that aircraft engineers and scientists continue to face. While no easy, comprehensive answers exist, the staff at NASAs Icing Research Tunnel (IRT) at the Glenn Research Center in Cleveland has done pioneering work to make flight safer for experimental, commercial, and military customers. The National Advisory Committee for Aeronautics (NACA) initiated government research on aircraft icing in the 1930s at its Langley facility in Virginia. Icing research shifted to the NACA’s Cleveland facility in the 1940s. Initially there was little focus on icing at either location, as these facilities were more concerned with aerodynamics and engine development. With several high-profile fatal crashes of air mail carriers, however, the NACA soon realized the need for a leading research facility devoted to icing prevention and removal. The IRT began operation in 1944 and, despite renovations and periodic attempts to shut it down, has continued to function productively for almost 60 years. In part because icing has proved so problematic over time, IRT researchers have been unusually open-minded in experimenting with a wide variety of substances, devices, and techniques. Early icing prevention experiments involved grease, pumping hot engine exhaust onto the wings, glycerin soap, mechanical and inflatable ”boots,” and even corn syrup. The IRT staff also looked abroad for ideas and later tried a German and Soviet technique of electromagnetism, to no avail. More recently, European polymer fluids have been more promising. The IRT even periodically had ”amateur nights” in which a dentist’s coating for children’s teeth proved unequal to the demands of super-cooled water droplets blown at 100 miles per hour. Despite many research dead-ends, IRT researchers have achieved great success over the years. They have developed important computer models, such as the LEWICE software, and made significant contributions to prevent ice buildup on turbine-powered commercial aircraft, helicopters, and military planes.

Author

*Aircraft Safety; Aircraft Icing; Freezing; Accident Prevention; Research Facilities; Histories*

**20020066287** Transportation Research Board, Washington, DC USA

**Airports in the 21st Century: Proceedings of a Conference**

Rakas, J. M.; Blomme, G. W.; Gosling, G.; Apr. 20, 2000; 500p; In English; This document is color dependent and/or in Landscape layout. It is currently only available on CD-ROM

Report No.(s): PB2002-107760; E-C027; No Copyright; Avail: National Technical Information Service (NTIS)

The Transportation Research Board and Federal Aviation Administration cosponsored a one-day conference in Washington, D.C., on April 20, 2000, to review the outlook for airports in the 21st century. The Conference focused on development that is expected to take place at major metropolitan airports to help accommodate growth in air travel during the next 25 years. The program considered the major technological and institutional measures that may be combined to increase the capacity of the airport system and to help meet the rising demand for air transportation. Industry experts presented information on the prospects for improved airport infrastructure, aircraft technology, and air traffic control technology in relation to future capacity requirements. The process of planning and undertaking major airport improvement programs was examined from the perspective of regional planning, environmental compatibility, and economic implications.

NTIS

*Airports; Planning; Air Traffic Control; Economics; Regional Planning*

**20020066288** Transportation Research Board, Washington, DC USA

**Aviation Gridlock: Understanding the Options and Seeking Solutions, Phase 1, Airport Capacity and Demand Management**

Feb. 16, 2001; In English; This document is color dependent and/or in Landscape layout. It is currently only available on CD-ROM

Report No.(s): PB2002-107762; No Copyright; Avail: National Technical Information Service (NTIS)

The seminars aim to enhance public understanding of the issues, organizations, and possible solutions to air transportation problems as the nation enters a period of increased demand, limited capacity, and inclement weather patterns traditionally associated with summer. Phase I of the seminar series--the proceedings published in this Circular--focuses on demand management by examining three areas. The first is airport delay and congestion, addressed by looking at the anatomy of a delay, airline scheduling, and finally the customer’s perspective. The second set of presentations reviews administrative and market

demand management options. The third and final group of presentations covers the operational, legal, and political challenges in adopting new demand management strategies.
NTIS
*Airports; Capacity; Planning; Air Traffic; Management*

**20020066289** Transportation Research Board, Washington, DC USA
**Aviation Gridlock, Phase 2, Airport Capacity and Infrastructure**
May 2001; In English; This document is color dependent and/or in Landscape layout. It is currently only available on CD-ROM
Report No.(s): PB2002-107763; E-C032-Phase-2; No Copyright; Avail: National Technical Information Service (NTIS)

The seminars aim to enhance public understanding of the issues, organizations, and possible solutions to air transportation problems as the nation enters a period of increased demand, limited capacity, and inclement weather patterns traditionally associated with summer. Phase II of the series--the proceedings published in this Circular--examines airport capacity through improvements in infrastructure.
NTIS
*Airports; Air Transportation; Capacity; Airline Operations; Air Traffic Control*

**20020066540** Transportation Research Board, Washington, DC USA
**Aviation Gridlock: Understanding the Options and Seeking Solutions, Phase 3, Weather and Weather Technology**
May 16, 2001; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): PB2002-107764; TRB-E-C034; No Copyright; Avail: National Technical Information Service (NTIS)

As pressure increases on the national airspace system, including airports and supporting facilities and services, it is important that all elements of the system - commercial airlines; passengers; local, state, and federal governments; business and industry-understand and work together to maintain the world's safest and most efficient aviation system. to address this need, the Federal Aviation Administration and the Transportation Research Board have launched a series of three 1-day seminars on Aviation Gridlock: Understanding the Options and Seeking Solutions, with sessions in February, April, and May 2001 in the Lecture Room of the National Academy of Sciences, Washington, D.C. The seminars aim to enhance public understanding of the issues, organizations, and possible solutions to air transportation problems as the nation enters a period of increased demand, limited capacity, and inclement weather patterns traditionally associated with summer.
NTIS
*Air Transportation; Weather; Airline Operations; Management Planning; Aerospace Safety*

**20020066673** NASA Ames Research Center, Moffett Field, CA USA
**A Survey of Flight Crew Experience with FANS-1 ATC Datalink**
Smith, Nancy, NASA Ames Research Center, USA; Moses, John, San Jose State Univ., USA; Polson, Peter,, Colorado Univ., USA; Romahn, Stephen, San Jose State Univ., USA; Palmer, Everett, NASA Ames Research Center, USA; [1998]; 1p; In English; 10th International Conference on Aviation Psychology, 2-7 May 1999, Columbus, OH, USA
Contract(s)/Grant(s): NASA Order H-4749-I; RTOP 538-04-14; No Copyright; Avail: Issuing Activity; Abstract Only

A survey was used to collect data from Boeing 747-400 pilots who fly with three international carriers about their operational experience using FANS-1 CPDLC (controller-pilot datalink communication) for oceanic communication with air traffic control (ATC). The survey provides data characterizing the operators' experiences performing all routine datalink communication tasks, with the goal of determining how well the FANS-1 CPDLC system supports task performance, the problems flight crews experience when using the system, and the possible operational consequences of those problems. Survey questions were developed from an analysis of activities performed by pilots when using FANS-1 CPDLC. Seven routine tasks were identified: (1) preflight initialization; (2) ATC facility logon; (3) monitoring ATC facility handoffs; (4) monitoring integrity of FANS- 1 CPDLC connection; (5) responding to ATC communications; (6) sending ATC requests; and (7) sending ATC position reports. A decomposition of each task described its information requirements, task timing requirements, user interface actions, company procedures and documentation, and the available cues and feedback provided by the interface. This analysis was used to determine where the system might provide poor support for task performance, and survey questions were developed to determine whether operator experience reflected problems in these areas.
Author
*Data Links; Crew Procedures (Inflight); Crew Procedures (Preflight); Flight Crews; Human-Computer Interface; Air Traffic Control*

**20020066704** NASA Ames Research Center, Moffett Field, CA USA

**Controller Strategies for Managing Air Traffic in High Altitude Arrival Sectors**

Smith, Nancy, NASA Ames Research Center, USA; Palmer, Everett, NASA Ames Research Center, USA; Prevot, Thomas, San Jose State Univ., USA; [1998]; 1p; In English; 10th International Conference on Aviation Psychology, 2-7 May 1999, Columbus, OH, USA

Contract(s)/Grant(s): NASA Order H-4749-I; RTOP 588-04-14; No Copyright; Avail: Issuing Activity; Abstract Only

Substantial increases in the volume of air traffic in the National Airspace System (NAS) are forecast for the next decade, with the number of passengers travelling on U.S. airlines expected to increase by as much as 60%. This increased demand on system capacity will be accompanied by increases in traffic complexity as air traffic service providers routinely accommodate user preferred routing requests. Changes to the NAS to meet these new demands are currently underway, including development of new decision support tools to aid controllers in monitoring and managing air traffic, and increased air-to-air and air-to-ground information exchange. Changes in roles and responsibilities of pilots and controllers in flight path management will accompany these changes in traffic patterns and information technology, however the ultimate responsibility for maintaining aircraft separation will remain with the air traffic controller. A thorough understanding of the methods controllers use to manage air traffic will help ensure that changes to the NAS are implemented in a way that maintains the controller's ability to separate aircraft as the system evolves. This presentation describes the strategies controllers use today to manage arrival traffic in its descent from cruise altitude to the Terminal Radar Approach Control (TRACON) boundary. Factors that increase the complexity of this task include the presence of overflight traffic, varying aircraft performance characteristics, winds aloft, ground speed variations with altitude, the need to merge arrival traffic into a single stream, and, when arrival traffic exceeds airport runway capacity, the added task of metering flow into the TRACON. Because of the limited information available to controllers to manage arrival traffic, their strategies are often driven by the need to reduce the task's complexity, which can result in de-optimized flight paths for individual aircraft (e.g., sub-optimal descent or speed profiles). Understanding these strategies and the cognitive demands that drive them will support a safe transition to a NAS that relies on enhanced technologies. In addition, it could enable system developers to identify opportunities for new automation-based procedures or information displays that could reduce the controller's workload and increase operational efficiency.

Author

*National Airspace System; Radar Approach Control; Air Traffic Controllers (Personnel); Terminal Guidance; Flight Management Systems; Aircraft Approach Spacing; Flight Paths; High Altitude*

**20020066750** Transportation Research Board, Washington, DC USA

**Future Flight: A Review of the Small Aircraft Transportation System Concept**

2002; 138p; In English

Report No.(s): PB2002-107842; TRB/SP-263; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Background information on the general aviation (GA) technology research programs of the National Aeronautics and Space Administration (NASA), including its Small Aircraft Transportation System (SATS) concept and plans to further it through a 5-year technology development and demonstration program, is provided in this chapter. As a key part of its SATS concept, NASA envisions small aircraft being flown between small airports in currently lightly used airspace to provide an increasingly larger share of the nations intercity personal and business travel. The approach taken in this study to examine the SATS concept vision and the 5-year program to advance it are then described.

NTIS

*General Aviation Aircraft; Transportation Networks*

**20020067415** San Jose State Univ., Moffett Field, CA USA

**Evaluation of a Terminal Area In-Trail Approach Spacing, Project and Study *Final Report***

Shelden, Stephen, San Jose State Univ., USA; Johnson, Walter, Editor, San Jose State Univ., USA; April 2001; 76p; In English

Contract(s)/Grant(s): NCC2-1095

Report No.(s): NASA/CR-2001-210920; NAS 1.26:210920; A-00V0042; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Reported here are the results of work completed as a precursor to Distributed Air Ground (DAG), Concept Element 11 (CE11) research. CE11 is a NASA, Advanced Air Transportation Technologies (AATT) concept initiated to promote research on in-trail merging and spacing during approach in the terminal area environment, such that improvements to the National Air Space (NAS) may be realized. A description of the project concept, results of a preliminary study, and a literature review are presented. In terms of conclusions, study results, and reference material respectively: 1) the concept is supported as being significant to NAS capacity improvement, 2) the preliminary study indicated that having more than one downstream, in-trail aircraft present on a CDTI during

approach may be advantageous, and that flying traditional Standard Terminal Arrival Routes (STAR) utilizing advanced decision support tools (DST) may be complicated by wake turbulence considerations, a lack of vertical awareness on the part of the flight crew, and the 'step-down' nature of many terminal area approaches, and 3) the results of a literature review are presented for future reference.
Author
*Wakes; Turbulence; Airspace; Evaluation*

## 04
## AIRCRAFT COMMUNICATIONS AND NAVIGATION

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

**20020065349** General Accounting Office, Washington, DC USA
**National Airspace System: FAA's Approach to Its New Communications System Appears Prudent, but Challenges Remain**
Jul. 2002; 28p; In English; Response to Congressional Requesters
Report No.(s): AD-A403576; GAO-02-710; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The Federal Aviation Administration (FAA) uses radios to provide air-ground voice and data communications for pilots and air traffic controllers to safely coordinate all flight operations-ground movements of aircraft at airports, take-offs and landings, and separation distances between aircraft as they cruise at high altitudes. However, the anticipated growth in air traffic, coupled with FAA's efforts to reduce air traffic delays and introduce new air traffic services, will create a demand for additional channels for voice communications that FAA's current system cannot provide. FAA is implementing a new communications system to respond to this challenge and also seeking to enhance its existing ability to transmit data to provide more information to pilots, reduce errors in voice communications, and better balance controllers' workload. Moreover, FAA expects that its new system should be less susceptible to interference from such sources as power lines and radio and television stations and also improve security against unauthorized users. FAA is developing products to use with its future integrated voice and data communications system. FAA refers to the initiative to acquire this system as Next Generation Air/Ground Communications (NEXCOM) and estimates that its long-term funding commitment for this initiative could reach $4 billion through fiscal year 2023.
DTIC
*Voice Communication; Flight Management Systems; Data Transmission; Telecommunication*

**20020065443** Defence Science and Technology Organisation, Surveillance Systems Div., Edinburgh Australia
**Converting GPS Coordinates (phi, lambda, h) to Navigation Coordinates (ENU)**
Drake, S. P., Defence Science and Technology Organisation, Australia; April 2002; 9p; In English
Report No.(s): DSTO-TN-0432; DODA-AR-012-335; Copyright; Avail: Issuing Activity
In many applications relevant to the Australian Defence Force (ADF) it is necessary to convert the Global Positioning System (GPS) coordinates of latitude, longitude and height to a local navigation frame with coordinates, east, north and tip. For example when testing navigation instruments, such as the inertial navigation system (INS), it is often helpful to compare these measurements with those obtained from an independent GPS receiver. An INS records the east, north and up displacement from its point of origin, to compare INS and GPS measurements we need to transform GPS coordinates to navigation coordinates. Furthermore, east, north, up coordinates are essential in determining the line of sight for terrain data given as latitude, longitude and height, such as digital terrain elevation data (I)TED). For large amounts of data, e.g, trial data, this process may be very computationally intensive. Means for converting GPS data to navigation frame coordinates already exist. However, the method presented in this report is roughly three times faster than a commonly employed one. The coordinate transformation routine outlined in this report is accurate to within 10m over a range of 60km. The coordinate transformation method outlined here will he used in the Navwar simulation package currently under development in DSTO Edinburgh. It will have the effect of significantly reducing the processing time of line of sight calculations in jamming models.
Author
*Global Positioning System; Coordinate Transformations; Longitude; Inertial Navigation*

**20020066302** Federal Aviation Administration, Office of Aviation Research, Atlantic City, NJ USA
**Temporary Installation Methods for PAPI/A-PAPI Systems** ***Final Report***
Bagot, K.; Jan. 2002; In English
Report No.(s): PB2002-104730; DOT/FAA/AR-01/111; No Copyright; Avail: National Technical Information Service (NTIS)

Airports have a need to temporarily install and precision approach path indicator (PAPI) or an abbreviated PAPI (A-PAPI) to provide accurate approach slope guidance when a runway threshold is temporarily displaced due to construction or maintenance projects. Airports have been reluctant to pour concrete foundations for temporary installations because of the cost and impact on operations. However, since the vertical alignment of the PAPI system is critical, a temporary installation method must take into consideration the need temporary installation methods that were effective in maintaining proper aiming angles within the Federal Aviation Administration Advisory Circular 150/5345-28 limitations.
NTIS
*Airports; Precision; Runways; Maintenance; Pavements; Approach Indicators*

**20020066497** Microwave Monolithics, Inc., Simi Valley, CA USA
**Personal Beacon**
Spinoff 2000; 2000, pp. 49; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

The MicroPLB (personal locator beacon) is a search and rescue satellite-aided tracking (SARSAT) transmitter. When activated it emits a distress signal to a constellation of internationally operated satellites. The endangered person's identity and location anywhere on Earth is automatically forwarded to central monitoring stations around the world. It is accurate to within just a few meters. The user uses the device to download navigation data from a global positioning satellite receiver. After the download is complete, the MicroPLB functions as a self-locating beacon. Also, it is the only PLB to use a safe battery. In the past, other PLB devices have used batteries that have enough volatility to explode with extreme force. It was developed by Microwave Monolithic, Inc. through SBIR funding from Glenn Research Center and Goddard Space Flight Center.
Author
*Technology Utilization; Tracking (Position); Beacons; Position Indicators; Homing Devices; Global Positioning System*

**20020066646** National Aerospace Lab., Amsterdam, Netherlands
**Slot Allocation by Column Generation**
vandenAkker, J. M.; Nachtigall, K.; 1997; 36p; In English
Report No.(s): PB2002-105886; NLR-TP-97286; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A slot allocation policy assigns a time slot for departure to each of a number of flights in order to avoid overload in control sectors and on runways. We present a new solution method for a basic version of the European slot allocation problem. The approach is based on an integer linear programming model, where for each flight there is a set of 0-1 variables each associated with one of its possible departure slots. First, column generation is used to solve the LPrelaxation. This results in the construction of a reasonable set of departure slots for each of the flights. Then, the resulting integer linear program is solved. We also present a rounding heuristic to derive feasible integral solutions from fractional solutions after each iteration of the column generation algorithm. Computational results for real-world problems are encouraging, because they indicate that compared to existing exact optimisation algorithms our method generates solutions of approximately the same quality but requires only a fraction of the computation time. Moreover, they indicate that the rounding heuristic performs well.
NTIS
*Air Traffic Control; Parking; Applications Programs (Computers)*

**20020066662** NASA Ames Research Center, Moffett Field, CA USA
**A Cognitive-System Model for En Route Air Traffic Management**
Corker, Kevin M., NASA Ames Research Center, USA; Pisanich, Gregory, Sterling Software, Inc., USA; [1998]; 2p; In English; 2nd International Engineering Psychology and Cognitive Ergonomics Conference, 28 Oct. - 1 Nov. 1998, Oxford, UK
Contract(s)/Grant(s): RTOP 538-04-21; No Copyright; Avail: Issuing Activity; Abstract Only

NASA Ames Research Center has been engaged in the development of advanced air traffic management technologies whose basic form is cognitive aiding systems for air traffic controller and flight deck operations. In the design and evaluation of such systems the dynamic interaction between the airborne aiding system and the ground-based aiding systems forms a critical coupling for control. The human operator is an integral control element in the system and the optimal integration of human decision and performance parameters with those of the automation aiding systems offers a significant challenge to cognitive engineering. This paper presents a study in full mission simulation and the development of a predictive computational model of human performance.

We have found that this combination of methodologies provide a powerful design-aiding process. We have extended the computational model Man Machine Integrated Design and Analysis System (N13DAS) to include representation of multiple cognitive agents (both human operators and intelligent aiding systems), operating aircraft airline operations centers and air traffic control centers in the evolving airspace. The demands of this application require the representation of many intelligent agents sharing world-models, and coordinating action/intention with cooperative scheduling of goals and actions in a potentially unpredictable world of operations. The operator's activity structures have been developed to include prioritization and interruption of multiple parallel activities among multiple operators, to provide for anticipation (knowledge of the intention and action of remote operators), and to respond to failures of the system and other operators in the system in situation-specific paradigms. We have exercised this model in a multi-air traffic sector scenario with potential conflict among aircraft at and across sector boundaries. We have modeled the control situation as a multiple closed loop system. The inner and outer loop alerting structure of air traffic management has many implications that need to be investigated to assure adequate design. First, there are control and stability factors implicit in the design. As the inner loop response time approaches that of the outer loop, system stability may be compromised in that controllers may be solving a problem the nature of which has already been changed by pilot action. Second, information exchange and information presentation for both air and ground must be designed to complement as opposed to compete with each other. Third, the level of individual and shared awareness in trajectory modification and flight conformance needs to be defined. Fourth, the level of required awareness and performance impact of mixed fleet operations and failed-mode recovery must be explored.

Author

*Air Traffic Control; Automatic Control; Human Performance; Man Machine Systems; Performance Prediction*

**20020066674** NASA Ames Research Center, Moffett Field, CA USA

**An Operational Concept for Flying FMS Trajectories in Center and TRACON Airspace**

Palmer, Everett, NASA Ames Research Center, USA; Williams, David, NASA Langley Research Center, USA; Prevot, Thomas, San Jose State Univ., USA; Romanhn, Stephan, San Jose State Univ., USA; Goka, Tsuyoshi, Raytheon Co., USA; Smith, Nancy, NASA Ames Research Center, USA; Crane, Barry, San Jose State Univ., USA; Aug. 28, 1998; 1p; In English; International Conference on Aviation Psychology, 2-7 May 1999, Columbus, OH, USA

Contract(s)/Grant(s): RTOP 538-04-12; No Copyright; Avail: Issuing Activity; Abstract Only

Current Flight Management Systems (FMS) do a good job of constructing and flying an optimal trajectory for a single aircraft. Unfortunately, flight crews are often unable to fly these FMS routes during arrivals at busy airports. The Center TRACON Automation System (CTAS) has been designed to aid Center and TRACON (Terminal Radar Approach Control) controllers in assigning runways, sequencing and vectoring all classes of aircraft. CTAS bases its advisories on trajectory predictions for arriving aircraft using algorithms very similar to those in airborne FMS systems. This paper presents near and far term operational concepts for how a ground ATM (air traffic management) automation system like CTAS could work more effectively with the airborne automation in FMS equipped aircraft. The concepts for a more compatible air-ground system include: 1) a common route databases for both CTAS and FMS; 2) datalink to downlink information on aircraft weight, final approach speed and trajectory intent and to uplink wind information; 3) new FMS functions to allow flight crews to easily update their FMS trajectory to match the trajectory suggested by the ground automation with voice clearances, and 4) in the far term, datalink to downlink user preferred trajectories and to uplink trajectory clearances in the terminal area. The paper analyses some of the human factors issues that may result in allowing aircraft to fly FMS routes during enroute descent and in the terminal area. A series of linked human in the loop flight deck and air traffic control simulations and a field test with the NASA 757 are being conducted at NASA's Ames and Langley Research Centers to address these issues and to evaluate the operational feasibility of these approaches to more efficient flight and increased airport throughput.

Author

*Radar Approach Control; Terminal Guidance; Flight Management Systems; Trajectory Optimization; Approach Control; Flight Plans; Air Traffic Controllers (Personnel); Data Links*

**20020067401** NASA Marshall Space Flight Center, Huntsville, AL USA

**Tightly Coupled Inertial Navigation System/Global Positioning System (TCMIG)**

Watson, Michael D., NASA Marshall Space Flight Center, USA; May 28, 2002; 1p; In English; NanoSpace 2002, 25-27 Jun. 2002, Galveston, TX, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Many NASA applications planned for execution later this decade are seeking high performance, miniaturized, low power Inertial Management Units (IMU). Much research has gone into Micro-Electro-Mechanical System (MEMS) over the past decade as a solution to these needs. While MEMS devices have proven to provide high accuracy acceleration measurements, they have not yet proven to have the accuracy required by many NASA missions in rotational measurements. Therefore, a new solution has

been formulated integrating the best of all IMU technologies to address these mid-term needs in the form of a Tightly Coupled Micro Inertial Navigation System (INS)/Global Positioning System (GPS) (TCMIG). The TCMIG consists of an INS and a GPS tightly coupled by a Kalman filter executing on an embedded Field Programmable Gate Array (FPGA) processor. The INS consists of a highly integrated Interferometric Fiber Optic Gyroscope (IFOG) and a MEMS accelerometer. The IFOG utilizes a tightly wound fiber coil to reduce volume and the high level of integration and advanced optical components to reduce power. The MEMS accelerometer utilizes a newly developed deep etch process to increase the proof mass and yield a highly accurate accelerometer. The GPS receiver consists of a low power miniaturized version of the Blackjack receiver. Such an IMU configuration is ideal to meet the mid-term needs of the NASA Science Enterprises and the new launch vehicles being developed for the Space Launch Initiative (SLI).
Author
*Accelerometers; Global Positioning System; Inertial Navigation; Microelectromechanical Systems*

## 05
## AIRCRAFT DESIGN, TESTING AND PERFORMANCE

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

**20020065333** Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Victoria, Australia
**A Replacement Database for the CH - 47D Spectrometric Oil Analysis Program**
Marsden, Paul; Becker, Andrew; Mar. 2002; 80p; In English; Original contains color images
Report No.(s): AD-A403410; DSTO-TN-0412; DODA-AR-012-161; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

A Spectrometric Oil Analysis Program (SOAP) operates on selected Australian Defence Force platforms to assist in the prediction of incipient machinery failure. Historically, the data from the Australian Army CH-47D helicopters has been stored on a simple Microsoft Excel spreadsheet. DSTO was tasked by the Army Aircraft Logistic Management Squadron to assess the usefulness of this database. This report contains a detailed description of the replacement SOAP database designed by DSTO.
DTIC
*Data Bases; Oils; Spectrometers; Military Helicopters*

**20020065512** Naval Postgraduate School, Monterey, CA USA
**Estimation of Rotor Blade Torsional Deformations from Measured Blade Torsion Moments**
Volkin, Ronald S.; Mar. 2002; 157p; In English
Report No.(s): AD-A403707; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The strain pattern analysis (SPA) method is applied to estimate rotor blade torsional deflections. The SPA technique requires calculated mode shapes for the tested rotor blade and strain measurements from the rotor's wind tunnel or flight test. The Holzer method is developed to calculate the required mode shapes from rotor blade stiffness and mass properties and the torsional equation of motion. The Holzer method is tested with numerous theoretical and experimental cases and is proven accurate. The strain measurements are from wind tunnel tests conducted by the Army, NASA, United Technologies Research Center (UTRC) and Sikorsky at DNW with a (1:5.73) model-scale UH-60A rotor blade with an advance ratio of 0.301, an advancing tip Mach number of 0.8224 and an average Reynolds number of 1,278,729. The SPA method predicts slightly larger torsional deflections that compare well with the overall trend and range of UTRC static method integrated deflections. The SPA method was evaluated to determine the tolerance to change in the number of measurements and the modes applied, errors in the measurements, and errors in rotor blade stiffness and mass properties. The method is tolerant to all effects except a decrease in the number of measurements and modes.
DTIC
*Deformation; Torsion; Rotor Blades; Wind Tunnel Tests*

**20020066483** National Aerospace Lab., Amsterdam, Netherlands
**In-Flight Spectroscopic Aircraft emission Measurements**
Jentink, H. W.; van Veen, J. J. F.; Mar. 1999; 18p; In English
Report No.(s): PB2002-105862; NLR-TP-98390; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Aircraft emit their exhaust gases for the larger part during cruise conditions. The knowledge about the emissions in these conditions is limited because adequate in situ measurement methods are not available. In this report the complications encountered measuring exhaust gases in flight are addressed. The potential of spectroscopic measurement methods for this application is discussed. Experimental data gathered on ground are used to support the argumentation.
NTIS
*Spectroscopy; In-Flight Monitoring; Aircraft Engines; Exhaust Gases*

**20020066486** National Aerospace Lab., Amsterdam, Netherlands
**D-Sight Technique for Rapid Impact Damage Detection on Composite Aircraft Structures**
Heida, J. H.; Bruinsma, A. J. A.; Dec. 1997; 20p; In English
Report No.(s): PB2002-105884; NLR-TP-97646; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The D-Sight is an optical double-pass retroreflection surface inspection technique developed by Diffracto Ltd in Canada. It is a real-time technique for visualizing very small out-of-plane surface distortions and it is particularly applicable to the rapid and enhanced visual inspection of large surfaces. An evaluation of the D-Sight technique for the rapid detection and assessment of impact damage in composite aircraft structures is described. The viability, reliability limitations and possible improvements of the technique are discussed. The work has been performed within the EUCLID framework, RTP 3.1.'Aeronautical Application Technology', Work Package 2 'Global Diagnostic Damage Detection Methods'. A set of equations has been derived to establish the relation of various parameters of a D-Sight set-up. to quantify the inspection results, a D-Sight index has been introduced which represents the contrast of the D-Sight signature of a defect. Image processing routines have been designed for automatic detection of defects from D-Sight images. It is concluded that the D-Sight technique can reliably detect significant impact damage, with a damage area equal to or larger than 5 cm2 within a field of view of about 0.25 m2. The sensitivity of the technique corresponds to indent depths in the range of 0.01 to 0.05 mm. Inspections on a full-scale composite structure show that the D-Sight technique compares favourably with other inspection techniques, for the detection of impact damage and other defects with surface deformation.
NTIS
*Aircraft Structures; Detection; Image Processing; Retroreflection; Composite Structures; Damage Assessment*

**20020066542** Federal Aviation Administration, Washington, DC USA
**Inerting a Boeing 747SP Center Wing Tank Scale Model with Nitrogen-Enriched Air** ***Final Report***
May 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): PB2002-107849; DOT/FAA/AR-02/51; No Copyright; Avail: National Technical Information Service (NTIS)
Tests were performed in a 0.24 scale model of a Boeing 747SP center wing tank to validate the existing assumptions for inerting complex geometric spaces, which were developed from previous experiments, and to facilitate design of an efficient, cost-effective inerting gas deposit system for full-scale, ground-based inerting testing. The model was equipped with a variable nitrogen-enriched air distribution system, thermocouples, and oxygen analyzers that were monitored and recorded continuously by a data acquisition system during each test. The model was inerted in different configurations with different flow rates and bay distributions. The collected data was nondimensionalized in terms flow rate and tank size to allow for comparisons between tests. Experiments in the tank verified that the volumetric tank exchange established from research with a simple box-style tank can be achieved in a more complex compartmentalized tank. It also indicated that the same volumetric tank exchange could be obtained with less gas distribution (less complex distribution system) and that modification of the venting configuration to liminate cross-venting would improve the efficiency of the inerting process. Tests showed that the most efficient method of inerting the tank was to deposit all the nitrogen-enriched air in a single location, allowing for a lightweight, easily installed deposit system for an operational aircraft. Data from full-scale testing compared well with scale tank data illustrating that low cost, small-scale test articles can be an effective tool for developing inert gas distribution systems.
NTIS
*Fuel Tanks; Wing Tanks; Flight Tests; Scale Models; Nitrogen; Enrichment; Air*

## 06
## AVIONICS AND AIRCRAFT INSTRUMENTATION

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

**20020065365** Civil Aerospace Medical Inst., Oklahoma City, OK USA
**Automatic Dependent Surveillance-Broadcast/Cockpit Display of Traffic Information: Innovations in Pilot-Managed Departures *Final Report***
Prinzo, O. V.; Apr. 2002; 20p; In English
Report No.(s): PB2002-107795; DOT/FAA/AM-02/5; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Avionics devices that provide a cockpit display of traffic information (CDTI) enable pilots to acquire, verify, and maintain pre-defined spacing intervals from other aircraft. It is of interest to the Federal Aviation Administration to determine how the use of these displays influences pilot/controller operational communications. The operational evaluation of the CDTI in October 2000 provided an opportunity to examine some of these issues. Departure profiles (13 without CDTI, 32 with CDTI) were established to evaluate the ability of flight crews and air traffic controllers to manage long (6 nm) and short (4.5 nm) spacing intervals between departing aircraft during 3 day and 2 night operations. Subject-matter experts evaluated 15 hours of verbatim transcripts and audiotapes for benefits that may have resulted from pilot use of the ADS-B/CDTI. They also evaluated these communications for communication problems associated with misidentified aircraft, confusions, uncertainties, and operational concerns. Computed for each departure was the time the aircraft was under local control, runway ownership time, and the number and duration of messages. Approximately 4% of the departures conducted when CDTI was not used, and 9% when it was, involved communication problems. In particular, for pilot messages during CDTI departures, aircraft call signs were misstated or incorrect. However, when CDTI was not used, controller messages included the correct flight identifier but the wrong company name. In addition, more messages were exchanged during the short spacing interval. In contrast, when pilots executed CDTI departures, there was an overall increase in time on frequency, more time was spent under local control during the day, and departures were completed in less time when assigned the short spacing interval. Communication problems were associated with the call sign procedure that was designed to distinguish between aircraft being talked to versus talked about. Fortunately, controllers and pilots detected and corrected these problems in mid-stream, and statistically, communication efficiency was not affected. In light of the findings and comments from the controllers and pilots, alternative call sign procedures will be constructed and evaluated for the departure spacing application.

NTIS
*Air Traffic; Air Traffic Controllers (Personnel); Display Devices; Flight Control; Flight Safety*

**20020065422** Naval Air Systems Command, Structures Div., Patuxent River, MD USA
**AV-8B Integrated Earned Value Management System**
Borden, Debra L.; Zenthoefer, Mark J.; May 04, 1999; 39p; In English; Original contains color images; Papers and presentations from 15th Annual International College of Performance Management Conference held in St. Paul, Minnesota, May 2-5 1999. The original document contains color images
Report No.(s): AD-A403651; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

These viewgraphs discuss the Earned Value Management System, AV-8B operational requirements, avionics upgrades for legacy aircraft, challenges of avionics modernization, systems engineering approach, open systems benefits, EVMS integration overview and other related topics.

DTIC
*Avionics; Management Planning; Management Systems*

**20020065469** Naval Postgraduate School, Monterey, CA USA
**A Neural Network Approach for Helicopter Airspeed Prediction**
Samlioglu, Ozcan; Mar. 2002; 137p; In English; Original contains color images
Report No.(s): AD-A403551; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Conventional pitot-static airspeed measurement systems do not yield accurate measurements when aircraft speed is below 40 knots. Recent studies have demonstrated that neural network approaches for predicting airspeed are quite promising. In this thesis, a back-propagation neural network is used to predict the airspeed of UH-60A and OH-6A helicopters in the low speed environment. The input data to the neural networks were obtained using the FLIGHTLAB flight simulator. The results obtained

by flight simulation were validated by comparison to results of a previous study of the UH-60A helicopter based on actual flight data. The results of the work performed for this thesis show that at sea level the UH-60A low airspeed can be predicted with an accuracy of +/- 0. 71 knots and +/- 0.88 knots for out of ground effect and in ground effect conditions respectively. OH-6A analyses were performed at two pressure altitudes. At sea level the OH-6A airspeed can be predicted with an accuracy +/-0.75 knots when the aircraft is out of ground effect and +/- 0.88 knots when the helicopter is in ground effect. At a pressure altitude of 6000 feet OH-6A airspeed can be predicted with an accuracy of +/- 0.64 knots for both flight conditions.
DTIC
*Neural Nets; Helicopters; Airspeed*

**20020066672** NASA Ames Research Center, Moffett Field, CA USA
**Analysis of Autopilot Behavior**
Sherry, Lance, Honeywell, Inc., USA; Polson, Peter, Colorado Univ., USA; Feay, Mike, San Jose State Univ., USA; Palmer, Everett, NASA Ames Research Center, USA; [1998]; 1p; In English; International Conference on Aviation Psychology, 1 May 1999, USA
Contract(s)/Grant(s): RTOP 548-40-12; No Copyright; Avail: Issuing Activity; Abstract Only

Aviation and cognitive science researchers have identified situations in which the pilot's expectations for behavior of autopilot avionics are not matched by the actual behavior of the avionics. These "automation surprises" have been attributed to differences between the pilot's model of the behavior of the avionics and the actual behavior encoded in the avionics software. A formal technique is described for the analysis and measurement of the behavior of the cruise pitch modes of a modern Autopilot. The analysis characterizes the behavior of the Autopilot as situation-action rules. The behavior of the cruise pitch mode logic for a contemporary modern Autopilot was found to include 177 rules, including Level Change (23), Vertical Speed (16), Altitude Capture (50), and Altitude Hold (88). These rules are determined based on the values of 62 inputs. Analysis of the rule-based model also shed light on the factors cited in the literature as contributors to "automation surprises."
Author (revised)
*Automatic Pilots; Automatic Flight Control; Pilot Performance; Human Factors Engineering; Man Machine Systems*

## 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.*

**20020066249** Argonne National Lab., IL USA
**Assessing Condition of Turbin Engine Ceramic Components through NDE Technology**
Ellingson, W. A.; Sun, J. G.; Deemer, C.; Erdman, S.; Prested, C.; Jan. 2002; 18p; In English
Report No.(s): DE2002-42587; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Thermal barrier coatings (TBCs) and environmental barrier coatings (EBCs) are under development for hot-gas path components to allow higher gas-firing temperatures in advanced (high-efficiency, low-emission) gas turbines. Increasing dependence on the reliability of TBC and EBC components has driven the need for nondestructive evaluation (NDE) methods to assess the condition, or health status, of these coatings. NDE methods based on elastic optical scatter and thermal imaging have been applied to TBC-coated test specimens that were thermally cycled and to EBC-coated SiC/SiC components that were run in 4.5 MW(e) field-test turbines. One primary interest is to develop NDE methods that can predict a prespall condition. Resulting data suggest a correlation between laser scatter data and thermal cycles for TBC-coated specimens, and thermal imaging results have demonstrated prespall detection for an EBC-coated SiC/SiC combustor liner.
NTIS
*Ceramics; Thermal Control Coatings; Gas Turbines; Reliability; Protective Coatings; Gas Temperature*

**20020066551** Pittsburgh Univ., Dept. of Mechanical Engineering, Pittsburgh, PA USA
**Impermeable Thin Al2O3 overlay for TBC Protection from Sulfate and Vanadate Attack in Gas Turbines *Quarterly Report***
Mao, S. X.; Jan. 31, 2002; 10p; In English
Report No.(s): DE2002-793669; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The project started on September 1, 2001. During last 4 months, one post-doctor has been hired for this project. We have received TBC samples (YSZ/ CoNiCrAlY/ Inconel 601) from Tohoku University, Japan, while processing of the TBC samples was delayed in GE Corp. Research & Development. The TBC preparation in Japan was based on our technical requirement by plasma spray. Bond coat CoNiCrAlY and the YSZ was produced by low pressure plasma spray and air plasma spray respectively. The morphology of the surface and the microstructure of cross-section of the sample was observed and analyzed by SEM and EDX. XRD was also used to detect the phases in the YSZ. Currently we are processing the overlay Al2O3 on the TBC samples by EB-PVD and high velocity oxy-fuel (HVOF) spray techniques in collaboration with Penn. State University and State University of New York at Stony Brook. We will finish comparing the hot corrosion behavior of the Al2O3/YSZ/CoNiCrAlY/superalloy system with the YSZ/CoNiCrAlY/superalloy system. The mechanism of hot corrosion will be investigated. The processing-structure-properties relationship of the overlays will be determined.
NTIS
*Gas Turbines; Aluminum Oxides; Hot Corrosion; Protection*

**20020066763** State Univ. of New York, Dept. of Mechanical and Aerospace Engineering, Buffalo, NY USA
**Filtered Mass Density Function for Design Simulation of High Speed Airbreathing Propulsion Systems** ***Final Report, 1 Sep. 1999 - 31 Aug. 2002***
Givi, P., State Univ. of New York, USA; Madnia, C. K., State Univ. of New York, USA; Gicquel, L. Y. M., State Univ. of New York, USA; Sheikhi, M. R. H., State Univ. of New York, USA; Drozda, T. G., State Univ. of New York, USA; [2002]; 155p; In English
Contract(s)/Grant(s): NAG1-2238; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche
The objective of this research is to improve and implement the filtered mass density function (FDF) methodology for large eddy simulation (LES) of high speed reacting turbulent flows. NASA is interested in the design of various components involved in air breathing propulsion systems such as the scramjet. There is a demand for development of robust tools that can aid in the design procedure. The physics of high speed reactive flows is rich with many complexities. LES is regarded as one of the most promising means of simulating turbulent reacting flows.
Author
*Large Eddy Simulation; Turbulent Flow; Reacting Flow; Turbulence Models; Probability Density Functions*

## 08
## AIRCRAFT STABILITY AND CONTROL

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

**20020065363** Civil Aerospace Medical Inst., Oklahoma City, OK USA
**Applying Performance-Controlled Systems, Fuzzy Logic, and Fly-By-Wire Controls to General Aviation** ***Final Report***
Beringer, D. B.; May 2002; 18p; In English
Report No.(s): PB2002-107797; DOT/FAA/AM-02/7; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
A fuzzy-logic 'performance control' system, providing envelope protection and direct command of airspeed, vertical velocity, and turn rate, was evaluated in a reconfigurable general aviation simulator (configured as a Piper Malibu) at the FAA Civil Aerospace Medical Institute. Performance of 24 individuals (6 each of high-time pilots, low-time pilots, student pilots, and nonpilots) was assessed during a flight task requiring participants to track a 3-D course, from take-off to landing, represented by a graphical pathway primary flight display. Baseline performance for each subject was also collected with a conventional control system. All participants operated each system with minimal explanation of its functioning and no training. Results indicated that the fuzzy-logic performance control reduced variable error and overshoots, required less time for novices to learn (as evidenced by time to achieve stable performance), required less effort to use (reduced control input activity), and was preferred by all groups.
NTIS
*Control Systems Design; Fly by Wire Control; Aircraft Control; Fuzzy Systems; Aerospace Medicine*

**20020065461** University of Central Florida, Inst. for Simulation and Training, Orlando, FL USA
**Simulation of a Swarm of Unmanned Combat Air Vehicles (UCAVS)** ***Final Report, Jun. 2001-Feb. 2002***
Lin, Kuo-Chi; May 2002; 15p; In English
Contract(s)/Grant(s): F30602-01-1-0559; AF Proj. 558B
Report No.(s): AD-A403633; AFRL-IF-RS-TR-2002-99; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This research focuses on the control of the collective performance of a swarm of UCAVs. One control command string controls the motion of all UCAVs in a mission. There is no explicit coordination among diem. If the control command string is properly chosen, the motion of the swarm of UCAVs will perform well collectively. Genetic Algorithms (GA) are used in this research to find suitable control command strings. It is an effective method to get a very good solution if the mathematical optimum is not necessary. The objective is for UCAVs to maximize surveillance coverage in 20 time steps. The final fitness value is the average of the coverage percentiles of five 20-time-step results. Using GA, the best control command string found to control 10 UCAVs has the fitness value 0. 9603. This is an average of 96.03% of coverage, a very good result. Parametric and robustness analyses show that control may not be very robust. Monte Carlo simulation in conjunction with Genetic Algorithm is used to evolve robust control when wind-gust disturbance exists. The results of different approaches are compared.
DTIC
*Robustness (Mathematics); Surveillance*

**20020066512** Institute for Human Factors TNO, Soesterberg, Netherlands
**The Moving UAV Operator: Establishing Spatial Situational Awareness Using Multiple Dynamic Platforms** ***Final Report De Bewegend UAV-operator: Verkrijgen Van Ruimtelijk Situatioaneel Bewustzijn van Verscheidene Platformen***
deVries, S. C., Institute for Human Factors TNO, Netherlands; Jansen, C., Institute for Human Factors TNO, Netherlands; Feb. 22, 2002; 14p; In Dutch; Original contains color illustrations
Contract(s)/Grant(s): 013.31315; TNO Proj. 788.1
Report No.(s): TD-2001-0366; TNO-TM-02-A009; Copyright; Avail: Issuing Activity
When an Unmanned Aerial Vehicle (UAV) is controlled from a moving platform (e.g. a helicopter), the UAV-operator has to deal with various frames of reference, i.e. the world, the heli, and the UAV. The goal of the research was to determine whether visually determined ego-motion interacts with the task of answering questions regarding electronic situation displays, and which choice of map formatting is best. In a simulator experiment, we provided UAV operators with an electronic map in which the position and orientation of the heli, the UAV and other objects were indicated. The displays had two design dimensions: map orientation (north-up / heading heli up / heading UAV up) and map center (heli / UAV). During half of the trials motion feedback was given, i.e. large visuals showed the imagery corresponding to a view from the heli. Participants studied the movements of the symbols on the map displays for some time after which they had to answer questions about the situation depicted in the display. The questions asked for object relationships in world-centered terms or in vehicle-centered terms. The operators were also asked afterwards to indicate the flight paths of the heli and the UAV. There is clear evidence that the motion of the platform indeed influences the ability of the UAV operators to interpret the electronic maps. For instance, operators have more problems answering world-referenced questions when motion feedback is present, whereas heli-referenced questions are answered better in this case. Though not in all situations the best choice, the overall winner for the given task set was the north-up display.
Author
*Pilotless Aircraft; Flying Personnel; Operators (Personnel); Position Indicators; Sensory Perception; Man Machine Systems*

## 09
## RESEARCH AND SUPPORT FACILITIES (AIR)

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

**20020065274** Corps of Engineers, Washington, DC USA
**Engineering and Design: Aircraft Hangar Fire Protection Systems**
Cheung, Kisuk; Sep. 26, 1997; 43p; In English
Report No.(s): AD-A403288; ETL-1110-3-484; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This letter provides guidance for the design and construction of fire protection systems for hangars and similar facilities housing important and valuable military aircraft.
DTIC
*Hangars; Fire Prevention*

**20020065275** Corps of Engineers, Washington, DC USA
**Engineering and Design: Fire Protection for Helicopter Hangars**
Cheung, Kisuk; Oct. 15, 1997; 16p; In English
Report No.(s): AD-A403289; ETL-1110-3-485; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This letter provides criteria relative to the design and construction of fire protection features and systems at Army facilities.
DTIC
*Fire Prevention; Hangars; Helicopters*

**20020066478** NASA Marshall Space Flight Center, Huntsville, AL USA
**SD46 Facilities and Capabilities**
Ramachandran, N., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 2002 NASA Materials Science Conference, 25-26 Jun. 2002, Huntsville, AL, USA; Sponsored by NASA, USA
Contract(s)/Grant(s): NCC8-66; No Copyright; Avail: Issuing Activity; Abstract Only
The displays for the Materials Conference presents some of the facilities and capabilities in SD46 that can be useful to a prospective researcher from University, Academia or other government labs. Several of these already have associated personnel as principal and co-investigators on NASA peer reviewed science investigations. 1. SCN purification facility 2. ESL facility 3. Static and Dynamic magnetic field facility 4. Microanalysis facility 5. MSG Investigation - PFMI 6. Thermo physical Properties Measurement Capabilities.
Author
*Conferences; Microanalysis; Display Devices; Magnetostatic Fields*

**20020066479** NASA Marshall Space Flight Center, Huntsville, AL USA
**MSFC ESL Facility and Beamline Studies**
Rogers, J. R., NASA Marshall Space Flight Center, USA; Hyers, R. W., NASA Marshall Space Flight Center, USA; Rathz, T. J., NASA Marshall Space Flight Center, USA; Robinson, M. B., NASA Marshall Space Flight Center, USA; Kelton, K. F., NASA Marshall Space Flight Center, USA; Gangopadhyay, A. K., NASA Marshall Space Flight Center, USA; Woo, G. L., NASA Marshall Space Flight Center, USA; Fountain, G., NASA Marshall Space Flight Center, USA; Huie, D., NASA Marshall Space Flight Center, USA; Allen, T., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 2002 NASA Materials Science Conference, 25-26 Jun. 2002, Huntsville, AL, USA; No Copyright; Avail: Issuing Activity; Abstract Only
The poster presentation provides an overview of the MSFC ESL facility. The technical capabilities and accomplishments of the facility are summarized. Future plans including the development of a pressurized processing chamber and additional high-energy X-ray beamline studies are outlined.
Author
*General Overviews; Test Facilities; Beams (Radiation)*

**20020066638** Defence Science and Technology Organisation, Air Operations Div., Fishermans Bend, Australia
**An Auxiliary Interface Instrumentation Module for the AMRL Low Speed Wind Tunnel Data Acquisition System**
Bird, F. J., Defence Science and Technology Organisation, Australia; October 2001; 28p; In English; Original contains color illustrations
Report No.(s): DSTO-TR-1215; DODA-AR-012-026; Copyright; Avail: Issuing Activity
An IBM PC based electronic module is described which extends the capability of the data acquisition system of the Low Speed Wind Tunnel (LSWT) at the Aeronautical and Maritime Research Laboratory (AMRL). Occasions arise when wind tunnel measurements require external data input or specific data extraction by external or temporarily acquired equipment. Access to the data is provided by the Auxiliary Data Module (ADM). The ADM is one of the VME modules in the LSWT instrumentation console. The functions of two types of plug-in commercial board are used to provide a suite of digital input and output functions using a total of three boards. Two input, two output and two tachometer channels are provided by two identical I/O boards in addition to the two standard PC RS-232C serial communication ports. The second plug-in board type provides eight analog input channels and two analog output channels with 12 bit resolution.
Author
*Data Acquisition; Electronic Modules; IBM Personal Computers*

## 12
## ASTRONAUTICS (GENERAL)

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

**20020065436** California Univ., Space Sciences Lab., Berkeley, CA USA
**The Apollo 15 and 16 Particles and Fields Subsatellites, 1969-1975**
Anderson, Kinsey A., California Univ., USA; [2001]; 43p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A historical account of how the Particles and Field Subsatellites came to be carried on the Apollo 15 and 16 lunar missions written by one of the principal investigators of the project Kinsey Anderson. Topics covered include: A discussion of general scientific issues surrounding the mission, A summary of research being carried out in the mid to late 1960s regarding lunar particle shadows and magnetotail electric fields, and The development of the subsatellites and their successful releases on the Apollo 15 and 16 missions.
CASI
*Histories; Apollo 15 Flight; Apollo 16 Flight; Satellites*

**20020066159** NASA Marshall Space Flight Center, Huntsville, AL USA
**Mission Analysis for High Specific Impulse Deep Space Exploration**
Adams, Robert B., NASA Marshall Space Flight Center, USA; Polsgrove, Tara, NASA Marshall Space Flight Center, USA; [2002]; 2p; In English; 28th International Electric Propulsion Conference (IEPC), 17-21 Mar. 2003, Toulouse, France; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This paper describes trajectory calculations for high specific impulse engines. Specific impulses on the order of 10,000 to 100,000 sec are predicted in a variety of fusion powered propulsion systems. This paper and its companion paper seek to build on analyses in the literature to yield an analytical routine for determining time of flight and payload fraction to a predetermined destination. The companion paper will compare the results of this analysis to the trajectories determined by several trajectory codes. The major parameters that affect time of flight and payload fraction will be identified and their sensitivities quantified. A review of existing fusion propulsion concepts and their capabilities will also be tabulated.
Author
*Deep Space; Propulsion System Configurations; Space Exploration; High Impulse*

**20020066437** NASA, Washington, DC USA
**Aerospace Safety Advisory Panel *Annual Report, 2001***
[2002]; 69p; In English; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This Annual Report of the Aerospace Safety Advisory Panel (ASAP) presents results of activities during calendar year 2001. The year was marked by significant achievements in the Space Shuttle and International Space Station (ISS) programs and encouraging accomplishments by the Aerospace Technology Enterprise. Unfortunately, there were also disquieting mishaps with the X-43, a LearJet, and a wind tunnel. Each mishap was analyzed in an orderly process to ascertain causes and derive lessons learned. Both these accomplishments and the responses to the mishaps led the Panel to conclude that safety and risk management is currently being well served within NASA. NASA's operations evidence high levels of safety consciousness and sincere efforts to place safety foremost. Nevertheless, the Panel's safety concerns have never been greater. This dichotomy has arisen because the focus of most NASA programs has been directed toward program survival rather than effective life cycle planning. Last year's Annual Report focused on the need for NASA to adopt a realistically long planning horizon for the aging Space Shuttle so that safety would not erode. NASA's response to the report concurred with this finding. Nevertheless, there has been a greater emphasis on current operations to the apparent detriment of long-term planning. Budget cutbacks and shifts in priorities have severely limited the resources available to the Space Shuttle and ISS for application to risk-reduction and life-extension efforts. As a result, funds originally intended for long-term safety-related activities have been used for operations. Thus, while safety continues to be well served at present, the basis for future safety has eroded. Section II of this report develops this theme in more detail and presents several important, overarching findings and recommendations that apply to many if not all of NASA's programs. Section III of the report presents other significant findings, recommendations and supporting material applicable to specific program areas. Appendix A presents a list of Panel members. Appendix B contains the reaction of the ASAP to NASA's response to the calendar year 2000 findings and recommendations. In accordance with a practice started last year, this Appendix includes brief

narratives as well as classifications of the responses as 'open,' 'closed,' or 'continuing.' Appendix C details the Panel's activities during the reporting period.
Derived from text
*Aerospace Safety; NASA Programs; Space Shuttles; Safety Management; International Space Station; Technology Utilization*

**20020066782** Smithsonian Astrophysical Observatory, Cambridge, MA USA
**The Propulsive Small Expendable Deployer System (ProSEDS)** ***Annual Report, 1 Aug. 2001 - 31 Jul. 2002***
Lorenzini, Enrico C., Smithsonian Astrophysical Observatory, USA; July 2002; 66p; In English
Contract(s)/Grant(s): NAG8-1605; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This Annual Report covers the following main topics: 1) Updated Reference Mission. The reference ProSEDS (Propulsive Small Expendable Deployer System) mission is evaluated for an updated launch date in the Summer of 2002 and for the new 80-s current operating cycle. Simulations are run for nominal solar activity condition at the time of launch and for extreme conditions of dynamic forcing. Simulations include the dynamics of the system, the electrodynamics of the bare tether, the neutral atmosphere and the thermal response of the tether. 2) Evaluation of power delivered by the tether system. The power delivered by the tethered system during the battery charging mode is computed under the assumption of minimum solar activity for the new launch date. 3) Updated Deployment Control Profiles and Simulations. A number of new deployment profiles were derived based on the latest results of the deployment ground tests. The flight profile is then derived based on the friction characteristics obtained from the deployment tests of the F-1 tether. 4) Analysis/estimation of deployment flight data. A process was developed to estimate the deployment trajectory of the endmass with respect to the Delta and the final libration amplitude from the data of the deployer turn counters. This software was tested successfully during the ProSEDS mission simulation at MSFC (Marshall Space Flight Center) EDAC (Environments Data Analysis Center).
Author
*Tetherlines; Spacecraft Propulsion; Simulation; Cathodes; Tethering; Propulsion System Configurations*

**20020067443** NASA Marshall Space Flight Center, Huntsville, AL USA
**Simulation of Trajectories for High Specific Impulse Deep Space Exploration**
Polsgrove, Tara, NASA Marshall Space Flight Center, USA; Adams, Robert B., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 28th International Electric Propulsion Conference, 17-21 Mar. 2003, Toulouse, France; No Copyright; Avail: Issuing Activity; Abstract Only

Difficulties in approximating flight times and deliverable masses for continuous thrust propulsion systems have complicated comparison and evaluation of proposed propulsion concepts. These continuous thrust propulsion systems are of interest to many groups, not the least of which are the electric propulsion and fusion communities. Several charts plotting the results of well-known trajectory simulation codes were developed and are contained in this paper. These charts illustrate the dependence of time of flight and payload ratio on jet power, initial mass, specific impulse and specific power. These charts are intended to be a tool by which people in the propulsion community can explore the possibilities of their propulsion system concepts. Trajectories were simulated using the tools VARITOP and IPOST. VARITOP is a well known trajectory optimization code that involves numerical integration based on calculus of variations. IPOST has several methods of trajectory simulation; the one used in this paper is Cowell's method for full integration of the equations of motion. The analytical method derived in the companion paper was also used to simulate the trajectory. The accuracy of this method is discussed in the paper.
Author
*Computerized Simulation; Numerical Integration; Spacecraft Trajectories; Rocket Thrust; Trajectory Optimization; Trajectory Planning*

**20020067641** NASA Marshall Space Flight Center, Huntsville, AL USA
**An Analysis for the Use of Research and Education Networks and Commercial Network Vendors in Support of Space Based Mission Critical and Non-Critical Networking**
Bradford, Robert N., NASA Marshall Space Flight Center, USA; [2002]; 3p; In English; 23rd International Symposium on Space Technology and Science (ISTS), 26 May - 2 Jun. 2002, Matsue, Japan; No Copyright; Avail: Issuing Activity; Abstract Only

Currently, and in the past, dedicated communication circuits and "network services" with very stringent performance requirements are being used to support manned and unmanned mission critical ground operations at GSFC, JSC, MSFC, KSC and other NASA facilities. Because of the evolution of network technology, it is time to investigate using other approaches to providing mission services for space ground operations. The current NASA approach is not in keeping with the evolution of network technologies. In the past decade various research and education networks dedicated to scientific and educational endeavors have emerged, as well as commercial networking providers, that employ advanced networking technologies. These

technologies have significantly changed networking in recent years. Significant advances in network routing techniques, various topologies and equipment have made commercial networks very stable and virtually error free. Advances in Dense Wave Division Multiplexing will provide tremendous amounts of bandwidth for the future. The question is: Do these networks, which are controlled and managed centrally, provide a level of service that equals the stringent NASA performance requirements. If they do, what are the implication(s) of using them for critical space based ground operations as they are, without adding high cost contractual performance requirements? A second question is the feasibility of applying the emerging grid technology in space operations. Is it feasible to develop a Space Operations Grid and/or a Space Science Grid? Since these network's connectivity is substantial, both nationally and internationally, development of these sorts of grids may be feasible. The concept of research and education networks has evolved to the international community as well. Currently there are international RENs connecting the US in Chicago to and from Europe, South America, Asia and the Pacific rim, Russia and Canada. and most countries in these areas have their own research and education network as do many states in the USA.
Author
*Education; Space Missions; Communication Networks; Aerospace Sciences*

## 15
## LAUNCH VEHICLES AND LAUNCH OPERATIONS

*Includes all classes of launch vehicles, launch/space vehicle systems, and boosters; and launch operations. For related information see also 18 Spacecraft Design, Testing, and Performance; and 20 Spacecraft Propulsion and Power.*

**20020065332** RAND Corp., Santa Monica, CA USA
**Space Weapons Earth Wars**
Preston, Bob; Johnson, Dana J.; Edwards, Sean J.; Miller, Michael; Shipbaugh, Calvin; Jan. 2002; 221p; In English
Contract(s)/Grant(s): F49642-01-C-0003
Report No.(s): AD-A403411; RAND-MR-1209-AF; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

Space weapons for terrestrial conflict have been the subject of intense debate twice in the modern history of space. The first time, at the beginning of the Cold War, was over the possibility of bombardment satellites carrying nuclear weapons. The second time, at the end of the Cold War, was over the possibility of space-based defenses against nuclear missiles. Now, well past the Cold War, the topic of space weapons seems headed again for public debate, this time based on ballistic missile defense. National policy documents tacitly include the development of advanced technology to improve ballistic missile defense options. The latest space policy document from the Department of Defense (Cohen, 1999) supports 'ballistic missile defense and force projection'. to this end, the USA is developing space-based laser technology, which is approaching the demonstration phase. For these reasons, as well as the threat that space weapons could pose if developed by an adversary, it is time for public discussion of the subject. This report does not present an argument either for or against space weapons but instead describes their attributes and sets out a common vocabulary for future discussions. The report classifies and compares these weapons and explains how they might be used. It also explores ways in which the USA and other countries might decide to acquire them and the potential reaction of other countries if the USA or some other nation fielded such weapons. The report dispels some of the myths regarding space weapons to help ensure that debates and discussions are more fact based.
DTIC
*Space Weapons; Earth (Planet); Ballistic Missiles; Missile Defense*

**20020065568** NASA Marshall Space Flight Center, Huntsville, AL USA
**An Automated Method to Compute Orbital Re-Entry Trajectories with Heating Constraints**
Zimmerman, Curtis, NASA Marshall Space Flight Center, USA; Dukeman, Greg, NASA Marshall Space Flight Center, USA; Hanson, John, NASA Marshall Space Flight Center, USA; [2002]; 25p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Determining how to properly manipulate the controls of a re-entering re-usable launch vehicle (RLV) so that it is able to safely return to Earth and land involves the solution of a two-point boundary value problem (TPBVP). This problem, which can be quite difficult, is traditionally solved on the ground prior to flight. If necessary, a nearly unlimited amount of time is available to find the "best" solution using a variety of trajectory design and optimization tools. The role of entry guidance during flight is to follow the pre-determined reference solution while correcting for any errors encountered along the way. This guidance method is both highly reliable and very efficient in terms of onboard computer resources. There is a growing interest in a style of entry guidance

that places the responsibility of solving the TPBVP in the actual entry guidance flight software. Here there is very limited computer time. The powerful, but finicky, mathematical tools used by trajectory designers on the ground cannot in general be made to do the job. Nonconvergence or slow convergence can result in disaster. The challenges of designing such an algorithm are numerous and difficult. Yet the payoff (in the form of decreased operational costs and increased safety) can be substantial. This paper presents an algorithm that incorporates features of both types of guidance strategies. It takes an initial RLV orbital re-entry state and finds a trajectory that will safely transport the vehicle to a Terminal Area Energy Management (TAEM) region. During actual flight, the computed trajectory is used as the reference to be flown by a more traditional guidance method.
Author
*Reusable Launch Vehicles; Reentry Trajectories; Trajectory Optimization; Design Optimization; Boundary Value Problems; Flight Control*

**20020066164** NASA Marshall Space Flight Center, Huntsville, AL USA
**A Plan for Advanced Guidance and Control Technology for 2nd Generation Reusable Launch Vehicles**
Hanson, John M., NASA Marshall Space Flight Center, USA; [2002]; 9p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Advanced guidance and control (AG&C) technologies are critical for meeting safety/reliability and cost requirements for the next generation of reusable launch vehicle (RLV). This becomes clear upon examining the number of expendable launch vehicle failures in the recent past where AG&C technologies would have saved a RLV with the same failure mode, the additional vehicle problems where this technology applies, and the costs associated with mission design with or without all these failure issues. The state-of-the-art in guidance and control technology, as well as in computing technology, is at the point where we can took to the possibility of being able to safely return a RLV in any situation where it can physically be recovered. This paper outlines reasons for AG&C, current technology efforts, and the additional work needed for making this goal a reality.
Author
*Reusable Launch Vehicles; Flight Control; Failure Modes; Mission Planning*

**20020066496** Ultramet Co., Pacoima, CA USA
**Giving Bigger Satellites a Boost**
Spinoff 2000; 2000, pp. 43; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

Ultramet, Inc. has spurred a new process for producing rocket engine thrust chambers, through SBIR funding and the Glenn Research Center. High-temperature oxidation-resistant thruster materials are being produced in order to achieve high-temperature capability without sacrificing reliability. These thruster materials lead to an estimated three-percent improvement in propulsion system performance. to develop this material, Ultramet used a process called chemical vapor deposition (CVD). CVD involves heating precursors for metals, like iridium and rhenium, to temperatures at which they become gaseous. They are then deposited onto a mandrel, or spindle, layer-by-layer to produce high-density, highly resistant materials from the inside out.
Author
*Refractory Materials; Thrust Chambers; Vapor Deposition; Rocket Engines*

## 18
## SPACECRAFT DESIGN, TESTING AND PERFORMANCE

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

**20020066160** NASA Marshall Space Flight Center, Huntsville, AL USA
**International Space Station: Past, Present, and Future**
Davis, N. Jan, NASA Marshall Space Flight Center, USA; Apr. 01, 2002; 65p; In English, 24-27 Jun. 2002, Meida, Mexico; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The presentation intended to provide a broad overview of what the International Space Station LISS) is and how it is being developed, who the International Partners are, and the vision for the Space Station. The presentation is predominantly pictorial with top-level station information included such as the size and weight, the amount of pressurized volume, amount of power, etc. that will be available when the station is completed. The presentation also acknowledges the countries participating in the ISS Program, the contributions of the International Partners in terms of both hardware elements and launches, the Crews that have helped assemble, outfit, and/or occupy the Station, and the research that is already underway onboard. The major hardware elements to be delivered over the next several years are shown and the presentation ends with slides giving the overall functionality and capabilities the International Space Station will provide when complete.
Author
*International Space Station; Assembling; Design Analysis*

**20020066395** NASA Ames Research Center, Moffett Field, CA USA
**Model Based Autonomy for Robust Mars Operations**
Kurien, James A., NASA Ames Research Center, USA; Nayak, P. Pandurang, RECOM Technologies, Inc., USA; Williams, Brian C., NASA Ames Research Center, USA; September 1998; 8p; In English; The Founding Convention of the Mars Society, August 1998, Boulder, CO, USA
Contract(s)/Grant(s): NCC2-1006; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Space missions have historically relied upon a large ground staff, numbering in the hundreds for complex missions, to maintain routine operations. When an anomaly occurs, this small army of engineers attempts to identify and work around the problem. A piloted Mars mission, with its multiyear duration, cost pressures, half-hour communication delays and two-week blackouts cannot be closely controlled by a battalion of engineers on Earth. Flight crew involvement in routine system operations must also be minimized to maximize science return. It also may be unrealistic to require the crew have the expertise in each mission subsystem needed to diagnose a system failure and effect a timely repair, as engineers did for Apollo 13. Enter model-based autonomy, which allows complex systems to autonomously maintain operation despite failures or anomalous conditions, contributing to safe, robust, and minimally supervised operation of spacecraft, life support, In Situ Resource Utilization (ISRU) and power systems. Autonomous reasoning is central to the approach. A reasoning algorithm uses a logical or mathematical model of a system to infer how to operate the system, diagnose failures and generate appropriate behavior to repair or reconfigure the system in response. The 'plug and play' nature of the models enables low cost development of autonomy for multiple platforms. Declarative, reusable models capture relevant aspects of the behavior of simple devices (e.g. valves or thrusters). Reasoning algorithms combine device models to create a model of the system-wide interactions and behavior of a complex, unique artifact such as a spacecraft. Rather than requiring engineers to all possible interactions and failures at design time or perform analysis during the mission, the reasoning engine generates the appropriate response to the current situation, taking into account its system-wide knowledge, the current state, and even sensor failures or unexpected behavior.
Author
*Man Machine Systems; Human Factors Engineering; Manned Mars Missions; Artificial Intelligence; Algorithms; Reliability; Automatic Control*

**20020066581** General Accounting Office, Washington, DC USA
**Space Station: Actions Under Way to Manage Cost, but Significant Challenges Remain**
Jul. 2002; 32p; In English
Report No.(s): PB2002-108126; GAO-02-735; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The National Aeronautics and Space Administration (NASA) has reportedly spent about $20 billion for developing and operating the International Space Station, but faces many challenges in completing the development of a station that will meet program objectives. You asked that we (1) identify the reasons for the cost increase and analyze the mechanisms that should have alerted NASA to the cost increase and the need for mitigation plans, (2) assess the impact of the cost growth on the utility of the U.S. science program, (3) identify the corrective actions planned by NASA, and (4) provide any preliminary observations on the feasibility and status of NASA's actions to mitigate the problem.
NTIS
*Space Stations; Financial Management; Congressional Reports*

## 20
## SPACECRAFT PROPULSION AND POWER

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

**20020065373** Air Materiel Command, Wright-Patterson AFB, OH USA
**BMW Rocket Engine Development**
Singelmann, Dietrich; Mueller, Heinz; May 1948; 52p; In English
Report No.(s): AD-A402594; AMC-AF-F-TR-2201-ND; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
No abstract.
Author
*Rocket Engines; Engine Design*

**20020066161** NASA Marshall Space Flight Center, Huntsville, AL USA
**Selection and Prioritization of Advanced Propulsion Technologies for Future Space Missions**
Eberle, Bill, NASA Marshall Space Flight Center, USA; Farris, Bob, NASA Marshall Space Flight Center, USA; Johnson, Les, NASA Marshall Space Flight Center, USA; Jones, Jonathan, NASA Marshall Space Flight Center, USA; Kos, Larry, NASA Marshall Space Flight Center, USA; Woodcock, Gordon, NASA Marshall Space Flight Center, USA; [2002]; 10p; In English; 38th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 7-10 Jul. 2002, Indianapolis, IN, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The exploration of our solar system will require spacecraft with much greater capability than spacecraft which have been launched in the past. This is particularly true for exploration of the outer planets. Outer planet exploration requires shorter trip times, increased payload mass, and ability to orbit or land on outer planets. Increased capability requires better propulsion systems, including increased specific impulse. Chemical propulsion systems are not capable of delivering the performance required for exploration of the solar system. Future propulsion systems will be applied to a wide variety of missions with a diverse set of mission requirements. Many candidate propulsion technologies have been proposed but NASA resources do not permit development of a] of them. Therefore, we need to rationally select a few propulsion technologies for advancement, for application to future space missions. An effort was initiated to select and prioritize candidate propulsion technologies for development investment. The results of the study identified Aerocapture, 5 - 10 KW Solar Electric Ion, and Nuclear Electric Propulsion as high priority technologies. Solar Sails, 100 Kw Solar Electric Hall Thrusters, Electric Propulsion, and Advanced Chemical were identified as medium priority technologies. Plasma sails, momentum exchange tethers, and low density solar sails were identified as high risk/high payoff technologies.
Author
*Space Missions; Propulsion System Performance; Propulsion System Configurations; Nuclear Electric Propulsion*

**20020066562** Boeing Co., Rocketdyne Propulsion and Power, Huntsville, AL USA
**Integrated System Test of an Airbreathing Rocket**
Mack, Gregory, Pratt and Whitney Space Propulsion, USA; Beaudry, Charles, Aerojet-General Corp., USA; Ketchum, Andrew, Boeing Co., USA; [2002]; 14p; In English; 6th International Symposium on Propulsion for Space Transportation for the 21st Century, 14-16 May 2002, Versailles, France; Sponsored by Association Aeronautique et Astronautique de France, France
Contract(s)/Grant(s): NAS8-02001; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This viewgraph presentation provides information on NASA's attempts to develop an air-breathing propulsion in an effort to make future space transportation safer, more reliable and significantly less expensive than today's missions. Spacecraft powered by air-breathing rocket engines would be completely reusable, able to take off and land at airport runways and ready to fly again within days. A radical new engine project is called the Integrated System Tests of an Air-breathing Rocket, or ISTAR.
Derived from text
*Air Breathing Engines; Spacecraft Propulsion; Systems Engineering*

**20020066565** NASA Marshall Space Flight Center, Huntsville, AL USA

**Trajectories for High Specific Impulse High Specific Power Deep Space Exploration**

Polsgrove, Tara, NASA Marshall Space Flight Center, USA; Adams, Robert B., NASA Marshall Space Flight Center, USA; Jul. 10, 2002; 1p; In English; 38th AIAA/ASME/SAE/ASEE Joint Propulsion Conference, 7-10 Jul. 2002, Indianapolis, IN, USA; Sponsored by American Inst. for Research, USA

Report No.(s): AIAA Paper 2002-4233; No Copyright; Avail: Issuing Activity; Abstract Only

Flight times and deliverable masses for electric and fusion propulsion systems are difficult to approximate. Numerical integration is required for these continuous thrust systems. Many scientists are not equipped with the tools and expertise to conduct interplanetary and interstellar trajectory analysis for their concepts. Several charts plotting the results of well-known trajectory simulation codes were developed and are contained in this paper. These charts illustrate the dependence of time of flight and payload ratio on jet power, initial mass, specific impulse and specific power. These charts are intended to be a tool by which people in the propulsion community can explore the possibilities of their propulsion system concepts. Trajectories were simulated using the tools VARITOP and IPOST. VARITOP is a well known trajectory optimization code that involves numerical integration based on calculus of variations. IPOST has several methods of trajectory simulation; the one used in this paper is Cowell's method for full integration of the equations of motion. An analytical method derived in the companion paper was also evaluated. The accuracy of this method is discussed in the paper.

Author

*Electric Propulsion; Fusion Propulsion; Propulsion System Configurations; Computerized Simulation; Trajectories; Applications Programs (Computers); Spacecraft Propulsion; Specific Impulse; High Impulse*

**20020066568** ATK-Thiokol Propulsion, Brigham City, UT USA

**Evaluation of a Multi-Axial, Temperature, and Time Dependent (MATT) Failure Model**

Richardson, D. E., ATK-Thiokol Propulsion, USA; Anderson, G. L., ATK-Thiokol Propulsion, USA; Macon, D. J., ATK-Thiokol Propulsion, USA; [2002]; 8p; In English; AIAA Joint Propulsion Conference, 7-10 Jul. 2002, Indianapolis, IN, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NAS8-97238; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

To obtain a better understanding the response of the structural adhesives used in the Space Shuttle's Reusable Solid Rocket Motor (RSRM) nozzle, an extensive effort has been conducted to characterize in detail the failure properties of these adhesives. This effort involved the development of a failure model that includes the effects of multi-axial loading, temperature, and time. An understanding of the effects of these parameters on the failure of the adhesive is crucial to the understanding and prediction of the safety of the RSRM nozzle. This paper documents the use of this newly developed multi-axial, temperature, and time (MATT) dependent failure model for modeling failure for the adhesives TIGA 321, EA913NA, and EA946. The development of the mathematical failure model using constant load rate normal and shear test data is presented. Verification of the accuracy of the failure model is shown through comparisons between predictions and measured creep and multi-axial failure data. The verification indicates that the failure model performs well for a wide range of conditions (loading, temperature, and time) for the three adhesives. The failure criterion is shown to be accurate through the glass transition for the adhesive EA946. Though this failure model has been developed and evaluated with adhesives, the concepts are applicable for other isotropic materials.

Author

*Adhesives; Failure Analysis; Mathematical Models; Rocket Nozzles*

**20020066732** NASA Marshall Space Flight Center, Huntsville, AL USA

**System Description of the Gasdynamic Mirror Propulsion System**

Emrich, William Jr., NASA Marshall Space Flight Center, USA; Jun. 01, 2002; 1p; In English; American Nuclear Society Annual Meeting, Hollywood, FL, USA; Sponsored by American Nuclear Society, USA

Report No.(s): Track-53392; No Copyright; Avail: Issuing Activity; Abstract Only

Nuclear fusion appears to be a most promising concept for producing extremely high specific impulse rocket engines. One particular fusion concept which seems to be very well suited for fusion propulsion applications is the gasdynamic mirror (GDM). An experimental GDM device has been constructed at the NASA Marshall Space Flight Center to provide an initial assessment of the feasibility of this type of propulsion system. A systems shakedown of the device is currently underway with initial experiments slated to occur in early 2002. The device has been constructed so as to allow a considerable degree of flexibility in its configuration thus permitting the experiment to easily grow over time without necessitating a great deal of additional fabrication. This flexibility is due in large part to the modular nature of the machine wherein additional modules may be added

as needed to meet varying experimental objectives. Figure 1 shows the current configuration of the Gasdynamic Mirror Experiment, and Table 1 describes the main features of the device.
Author
*Mirrors; Fusion Propulsion; Nuclear Fusion; Rocket Engines; Specific Impulse*

**20020066762** NASA Marshall Space Flight Center, Huntsville, AL USA
**Ablative Laser Propulsion Using Multi-Layered Material Systems**
Nehls, Mary, NASA Marshall Space Flight Center, USA; Edwards, David, NASA Marshall Space Flight Center, USA; Gray, Perry, NASA Marshall Space Flight Center, USA; Schneider, T., NASA Marshall Space Flight Center, USA; [2002]; 4p; In English; 33rd AIAA Plasmadynamics and Lasers Conference, 20-23 May 2002, Maui, HI, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Experimental investigations are ongoing to study the force imparted to materials when subjected to laser ablation. When a laser pulse of sufficient energy density impacts a material, a small amount of the material is ablated. A torsion balance is used to measure the momentum produced by the ablation process. The balance consists of a thin metal wire with a rotating pendulum suspended in the middle. The wire is fixed at both ends. Recently, multi-layered material systems were investigated. These multi-layered materials were composed of a transparent front surface and opaque sub surface. The laser pulse penetrates the transparent outer surface with minimum photon loss and vaporizes the underlying opaque layer.
Derived from text
*Laser Propulsion; Microbalances; Laser Ablation; Pulsed Lasers; Springs (Elastic); Torsion*

**20020067391** NASA Marshall Space Flight Center, Huntsville, AL USA
**Fusion for Space Propulsion**
Thio, Y. C. Francis, NASA Marshall Space Flight Center, USA; Schmidt, George R., NASA Marshall Space Flight Center, USA; Santarius, John F., Wisconsin Univ., USA; Turchi, Peter J., Air Force Research Lab., USA; Siemon, Richard E., Los Alamos National Lab., USA; [2002]; 2p; In English; American Nuclear Society (ANS), 3-9 Jun. 2002, Hollywood, FL, USA; Sponsored by American Nuclear Society, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The need for fusion propulsion for interplanetary flights is discussed. For a propulsion system, there are three important system attributes: (1) The absolute amount of energy available, (2) the propellant exhaust velocity, and (3) the jet power per unit mass of the propulsion system (specific power). For efficient and affordable human exploration of the solar system, propellant exhaust velocity in excess of 100 km/s and specific power in excess of 10 kW/kg are required. Chemical combustion obviously cannot meet the requirement in propellant exhaust velocity. Nuclear fission processes typically result in producing energy in the form of heat that needs to be manipulated at temperatures limited by materials to about 2,800 K. Using the fission energy to heat a low atomic weight propellant produces propellant velocity of the order of 10 kinds. Alternatively the fission energy can be converted into electricity that is used to accelerate particles to high exhaust velocity. However, the necessary power conversion and conditioning equipment greatly increases the mass of the propulsion system. Fundamental considerations in waste heat rejection and power conditioning in a fission electric propulsion system place a limit on its jet specific power to the order of about 0.2 kW/kg. If fusion can be developed for propulsion, it appears to have the best of all worlds - it can provide the largest absolute amount of energy, the propellant exhaust velocity (> 100 km/s), and the high specific jet power (> 10 kW/kg). An intermediate step towards fusion propulsion might be a bimodal system in which a fission reactor is used to provide some of the energy to drive a fusion propulsion unit. There are similarities as well as differences between applying fusion to propulsion and to terrestrial electrical power generation. The similarities are the underlying plasma and fusion physics, the enabling component technologies, the computational and the diagnostics capabilities. These physics and engineering capabilities have been demonstrated for a fusion reactor gain (Q) of the order of unity (TFTR: 0.25, JET: 0.65, JT-60: Q(sub eq) approx. 1.25). These technological advances made it compelling for considering fusion for propulsion.
Author
*Fusion Propulsion; Controlled Fusion; Exhaust Velocity*

**20020067411** NASA Marshall Space Flight Center, Huntsville, AL USA
**The FRC Acceleration Space Thruster (FAST) Experiment**
Martin, Adam, NASA Marshall Space Flight Center, USA; Eskridge, Richard, NASA Marshall Space Flight Center, USA; Houts, Mike, NASA Marshall Space Flight Center, USA; Slough, John, Washington Univ., USA; [2002]; 1p; In English; Advanced Space Propulsion Workshop, 4-6 Jun. 2002, Pasadena, CA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The objective of the FRC (Field Reversed Configuration) Acceleration Space Thruster (FAST) Experiment is to investigate the use of a repetitive FRC source as a thruster, specifically for an NEP (nuclear electric propulsion) system. The Field Reversed

Configuration is a plasmoid with a closed poloidal field line structure, and has been extensively studied as a fusion reactor core. An FRC thruster works by repetitively producing FRCs and accelerating them to high velocity. An FRC thruster should be capable of I(sub sp)'s in the range of 5,000 - 25,000 seconds and efficiencies in the range of 60 - 80 %. In addition, they can have thrust densities as high as 10(exp 6) N/m2, and as they are inductively formed, they do not suffer from electrode erosion. The jet-power should be scalable from the low to the high power regime. The FAST experiment consists of a theta-pinch formation chamber, followed by an acceleration stage. Initially, we will produce and accelerate single FRCs. The initial focus of the experiment will be on the ionization, formation and acceleration of a single plasmoid, so as to determine the likely efficiency and I(sub sp). Subsequently, we will modify the device for repetitive burst-mode operation (5-10 shots). A variety of diagnostics are or will be available for this work, including a HeNe interferometer, high-speed cameras, and a Thomson-scattering system. The status of the experiment will be described.
Author
*Nuclear Electric Propulsion; Plasmas (Physics); Spacecraft Propulsion; Rocket Engines*

**20020067442** NASA Marshall Space Flight Center, Huntsville, AL USA
**In-Space Propulsion Program Overview and Status**
Carroll, Carol, NASA, USA; Johnson, Les, NASA Marshall Space Flight Center, USA; Baggett, Randy, NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 28th International Electric Propulsion Conference (IEPC), 17-21 Mar. 2003, Toulouse, France; No Copyright; Avail: Issuing Activity; Abstract Only

NASA's In-Space Propulsion (ISP) Program is designed to develop advanced propulsion technologies that can enable or greatly enhance near and mid-term NASA science missions by significantly reducing cost, mass, and/or travel times. These technologies include: Electric Propulsion (Solar and Nuclear Electric) [note: The Nuclear Electric Propulsion work will be transferred to the NSI program in FY03]; Propellantless Propulsion (aerocapture, solar sails, plasma sails, and momentum exchange tethers); Advanced Chemical Propulsion. The ISP approach to identifying and prioritizing these most promising technologies is to use mission analysis and subsequent peer review. These technologies under consideration are mid-Technology Readiness Level (TRL) up to TRL-6 for incorporation into mission planning within three - five years of initiation. In addition, maximum use of open competition is encouraged to seek optimum solutions under ISP. Several NASA Research Announcements (NRAs) have been released asking industry, academia and other organizations to propose propulsion technologies designed to improve our ability to conduct scientific study of the outer planets and beyond. The ISP Program is managed by NASA HQ (Headquarters) and implemented by the Marshall Space Flight Center in Huntsville, Alabama.
Author
*NASA Programs; Technology Assessment; Research and Development; Spacecraft Propulsion*

**20020067607** NASA Marshall Space Flight Center, Huntsville, AL USA
**High Power Thruster Based on Inductive Magnetized Plasmoid Acceleration**
Slough, John, Washington Univ., USA; Martin, Adam, NASA Marshall Space Flight Center, USA; Chavers, Greg, NASA Marshall Space Flight Center, USA; Thio, Francis, NASA Marshall Space Flight Center, USA; Jones, Johnathan, NASA Marshall Space Flight Center, USA; Nov. 20, 2001; 1p; In English; 38th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 7-10 Jul. 2002, Indianapolis, IN, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAG8-1849; No Copyright; Avail: Issuing Activity; Abstract Only

Regardless of the power source, deep space missions will require both high specific impulse (greater than 500 s) and high thrust power (greater than 100kW). These high Isp thrusters will need to have high electrical efficiency (approx. 90%) and low specific mass (alpha approximately less than 10 kg/kW) as well. Additionally they should have high thrust to allow greater mission flexibility. All these requirements can potentially be achieved with the pulsed formation and acceleration of magnetically self-confined plasmoids commonly referred to as compact toroids (CTs). An electromagnetic plasma thruster based on CT acceleration makes an ideal candidate for a high power, high Isp thruster, since the CT is magnetically isolated from the accelerator so that there is no contact between the propellant and the accelerator. The transfer of momentum to the CT occurs through an electromagnetic interaction with the magnetic field. By maintaining an axial magnetic field gradient across it, the directed velocity of the CT can be increased indefinitely. In previous experiments carried out at the University of Washington, CT's of near milligram mass were accelerated to velocities of 250 km/s in a single pulse. The ejection of the plasmoid by an external axial field also avoids the serious problem of detachment, which would occur in thrusters that employ a magnetic mirror or magnetic nozzle. to employ the CT for propulsion, one must design, construct and test a plasma source that is capable of generating a self-confined plasma inductively, and to do it repeatedly at a sufficiently high rep rate. A repetitively pulsed 100 kW level FRC thruster was built and was operated for short bursts at a 10 kHz rep rate and will be described. Another regime for the FRC thruster however is to produce an FRC in a more conventional manner at high voltage and magnetic field. With the large energy transfer with each

pulse, the rep rate for this approach is much lower (approximately 100 Hz). This is the approach that is being evaluated at MSFC in the FAST experiment. The purpose of this experiment is to build an FRC thruster, measure its performance characteristics e.g. specific impulse, thrust, and efficiency. This experiment will also be described as well as various mission scenarios that that are well matched for this type of propulsion.
Author
*Plasmas (Physics); Rocket Thrust; High Acceleration; Magnetization; Specific Impulse*

## 23
## CHEMISTRY AND MATERIALS (GENERAL)

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

**20020065534** NASA Ames Research Center, Moffett Field, CA USA
**Identification of Complex Carbon Nanotube Structures**
Han, Jie, NASA Ames Research Center, USA; [1998]; 1p; In English
Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-12; No Copyright; Avail: Issuing Activity; Abstract Only

A variety of complex carbon nanotube (CNT) structures have been observed experimentally. These include sharp bends, branches, tori, and helices. They are believed to be formed by using topological defects such as pentagons and heptagons to connect different CNT. The effects of type, number, and arrangement (separation and orientation) of defects on atomic structures and energetics of complex CNT are investigated using topology, quantum mechanics and molecular mechanics calculations. Energetically stable models are derived for identification of observed complex CNT structures.
Author
*Carbon Nanotubes; Nanostructure (Characteristics); Atomic Structure; Mathematical Models*

**20020065581** Argonne National Lab., Chemical Technology Div., IL USA
**Applications of Molecular Spectroscopy Methods to the Study of Metal Dusting Corrosion**
Maroni, V. A.; Feb. 2002; 20p; In English
Report No.(s): DE2002-793056; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This paper summarizes the possibilities and limitations involved in using various types of Raman and infrared measurement methods to study metal dusting corrosion. Applications of conventional, microprobe, and imaging molecular spectroscopy approaches are discussed, with examples taken directly from metal dusting investigations. Some perspective is offered concerning the origin of observable condensed matter phonons emanating from the surface films and the carbon particles that accompany carbon dusting on various types of metals and alloys. Concepts for the systematic investigation of carbon dusting chemistry using molecular spectroscopy methods are presented.
NTIS
*Imaging Techniques; Metals; Molecular Spectroscopy; Microanalysis; Corrosion*

**20020066303** National Inst. of Standards and Technology, Gaithersburg, MD USA
**Chemical Science and Technology Laboratory Annual Report FY2001** ***Annual Report***
Feb. 2002; In English; Available on CD-ROM and in paper copy only
Report No.(s): PB2002-102238; NISTIR-6856; No Copyright; Avail: National Technical Information Service (NTIS)

The Chemical Science and Technology Laboratory (CSTL) of the National Institute of Standards and Technology (NIST) is the USA' reference laboratory for chemical measurements, entrusted with developing, maintaining, advancing, and enabling the chemical measurement system for the U.S. thereby enhancing U.S. industry productivity and competitiveness, assuring equity in trade, and improving public health, safety, and environmental quality.
NTIS
*Research and Development; Chemical Composition; Chemical Reactions; Environmental Quality; Laboratories; Productivity*

**20020066311** NASA Langley Research Center, Hampton, VA USA
**National Educators' Workshop: Update 2001: Standard Experiments in Engineering, Materials Science, and Technology**
Jacobs, James A., Norfolk State Univ., USA; Jahanmir, Said, National Inst. of Standards and Technology, USA; Prior, Edwin J., Compiler, NASA Langley Research Center, USA; National Educators' Workshop: Update 2001 Standard Experiments in

Engineering, Materials Science, and Technology; June 2002; 748p; In English; National Educators' Workshop: Update 2001: Standard Experiments in Engineering, Materials Science, and Technology, 14-17 Oct. 2001, College Park, MD, USA; Sponsored by NASA, USA; Also announced as 20020066312 through 20020066360
Contract(s)/Grant(s): RTOP 772-30-10-32
Report No.(s): NASA/CP-2002-211735; NAS 1.55:211735; L-18193; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche

This document contains a collection of experiments presented and demonstrated at the National Educators' Workshop: Update 2001 held in College Park, Maryland, October 14-17, 2001.

Author

*Nanotechnology; Composite Materials; Education; Materials Science; Copolymers; Mechanical Properties*

**20020066312** National Inst. of Standards and Technology, Materials Science and Engineering Lab., Gaithersburg, MD USA

**Materials Research at NIST: Century of Progress**

Hall, Dale, National Inst. of Standards and Technology, USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 1-26; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

This paper presents various viewgraphs on Materials Research conducted at the National Institute of Standards and Technology.

CASI

*Materials Science; Ceramics; Copolymers*

**20020066314** Maryland Univ., Dept. of Materials and Nuclear Engineering, College Park, MD USA

**Teaching Undergraduates Results from Recent Research as Part of a Laboratory Class: X-Ray Diffraction Experiment**

Martinez-Miranda, L. J., Maryland Univ., USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 33-40; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

Copper samples prepared using electrodeless deposition on Aluminum Nitrade (AlN) substrates have been studied for interconnections. The method of deposition is less intrusive than other methods, which require the use of catalysts on an electrically insulated surface. The quality of the samples depends both on the direction of coating and the time the solution is refluxed. The samples which were prepared horizontally (parallel to the bottom of the flask) seemed to contain more Cu2O than the samples prepared vertically (perpendicular to the bottom of the flask). In both samples, the structural evolution was that Cu was more textured for lesser times and more polycrystalline for longer times in the reflux. The students will look at the effect of time 3 on the structure of the films.

Derived from text

*Education; X Ray Diffraction; Nanocrystals; Copper Oxides*

**20020066316** University of Southern Maine, School of Applied Science, Gorham, ME USA

**Active and Intelligent Materials**

Marshall, John A., University of Southern Maine, USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 63-68; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

The tunable characteristics of one of the most active and intelligent materials, magneto-rheological fluids are presented.

Derived from text

*Rheology; Smart Materials; Electromechanics; Hydraulic Fluids*

**20020066317** Maryland Univ., Materials Research Science and Engineering Center, College Park, MD USA

**University of Maryland MRSEC Research Experience for Undergraduates: Cultivating Tomorrow's Researcher**

Stott, Jennifer, Maryland Univ., USA; Hammer, Donna, Maryland Univ., USA; Williams, E. D., Maryland Univ., USA; Martinez-Miranda, L. J., Maryland Univ., USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 69-73; In English; Also announced as 20020066311
Contract(s)/Grant(s): NSF DMR-00-80008; No Copyright; Avail: CASI; A01, Hardcopy; A06, Microfiche

The University of Maryland MRSEC Summer Research Experience for Undergraduates provides the students with a well rounded educational experience doing materials research. Supplemental activities enhance the laboratory experience and provide students with opportunities to advance into graduate school and careers in science. Approximately 6 - 8 sophomores and juniors

with science and engineering backgrounds participate in the 10-week program. The REU offers a diverse range of research topics and includes a weekly seminar series, industrial tours of several neighboring facilities, and a tutorial on how to conduct oral and poster presentations. Research programs are available in Physics, Chemistry, Materials Science, and Electrical Engineering. The students get to present their research results twice during the course of the program.
Derived from text
*Education; Materials Science; Research Projects; Electrical Engineering*

**20020066322** Michigan Univ., Dept. of Mechanical Engineering, Dearborn, MI USA
**Lightweight Automotive Materials Research at the Center for Lightweighting Automotive Materials and Processing (CLAMP)**
Mallick, P. K., Michigan Univ., USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 111-124; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

Materials research at the Center for Lightweight Automotive Materials and Processing (CLAMP) is presented. The topics include: 1) Plastics and Composite Materials; 2) Lightweight Alloys; and 3) Processing. This paper is presented in viewgraph form.
CASI
*Automobiles; Materials Science; Mechanical Properties; Alloys; Pressing (Forming); Ceramic Matrix Composites*

**20020066328** Maryland Univ., Dept. of Materials and Nuclear Engineering, College Park, MD USA
**Combinatorial Approach to Materials Discovery**
Takeuchi, Ichiro, Maryland Univ., USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 217-239; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

This paper presents a combinatorial approach to materials discovery. The topics include: 1) Opportunities in Materials Science; 2) Making New Materials; 3) Synthesis of combinatorial libraries and composition spreads; 4) Rapid characterization and screening fo physical properties; and 5) Materials Diagnostics.
CASI
*Combinatorial Analysis; Materials Science; Superconductors (Materials); Fabrication*

**20020066335** Arizona State Univ., Chandler, AZ USA
**Lecture Activity Work Kits for Introductory Materials Engineering Classes**
Krause, Stephen, Arizona State Univ., USA; Anwar, Shahriar, Arizona State Univ., USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 325-332; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

This paper describes a series of hands-on activities that use student-centered learning for a diverse group of engineering students enrolled in larger sections of an engineering core class, "Structure and Properties of Materials". The "Lecture Activity Work Kits" supplement knowledge development from the more traditional teacher centered blackboard lectures. The "Lecture Activity Work Kits" involve short, 10 to 20 minute, team-based classroom activities, which relate directly to the topical material in the course at that time. Typical activities include manipulations of crystal structure models, polymer deformation, and examination or metal, polymer, and ceramic samples. Results of the activities are being tied to assessment of course objectives and outcomes through student surveys, quizzes, and tests. An initial assessment of activities by students has been quite positive. Results and techniques are being disseminated to other course faculty. There is good progress toward improvements in student interest, participation, and comprehension in the learning process.
Author
*Materials Science; Education; Lectures; Composite Materials*

**20020066338** Costa Rica Univ., Dept. of Materials, San Jose, Costa Rica
**The Atomic Mass Unit and the Avogadro Constant: An Approach to Introduce These Concepts**
Umana, Carlos E., Costa Rica Univ., Costa Rica; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 351-359; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

Most textbooks in the fields of chemistry, physics and materials science present an incomplete or a weak treatment of the origins and fundamentals of the atomic mass unit and the Avogadro constant. Sometimes explanations do not follow a logical

sequence or the key concepts are omitted. As a result confusion or misunderstanding about these basic constants is usually generated amongst students and even amongst instructors. Two main problems are identified: In the first place it is not usually clearly stated that mass spectrometers play a very important role concerning the necessity of having a relative atomic mass unit definition, due to the fact that absolute atomic masses cannot be experimentally obtained with mass spectrometers. Secondly the direct relationship existing between the Avogadro constant and the atomic mass unit is not usually well established. It is the intention of the author that the content of this paper should be helpful as an introduction to these topics in any basic course in chemistry, physics or materials science.
Derived from text
*Atomic Weights; International System of Units; Mass Spectrometers; Constants*

**20020066341** National Inst. of Standards and Technology, Metallurgy Div., Gaithersburg, MD USA
**The Center for Theoretical and Computational Materials Science**
Warren, James, National Inst. of Standards and Technology, USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 407-412; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

The mission of the Center for Theoretical and Computational Materials Science is to investigate important problems in materials theory and modeling with novel computational approaches; to create opportunities for collaboration; to develop powerful new tools for materials theory and modeling and accelerate their integration into industrial research. The topics include: 1) OOF: Object Oriented Finite Element Software; 2) First Principles Prediction of Phase Diagrams; 3) Multistage Simulations of Filled Polymers; 4) Phase Field Modeling of Microstructure; 5) Green's Functions for Elastic Properties; 6) Solder Interconnect Design Tools; 7) Micromagnetic Modeling Tools; and 8) Deformation of Aluminum.
Derived from text
*Materials Science; Microstructure; Computerized Simulation; Software Engineering; Mathematical Models*

**20020066351** San Jose State Univ., Dept. of Chemical and Materials Engineering, CA USA
**Overview of New: Update 2002**
Chung, W. Richard, San Jose State Univ., USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 509-523; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

A General Overview of the 17th Annual National Educators' Workshop (NEW) is presented.
CASI
*General Overviews; Education; Semiconductors (Materials); Chemical Engineering*

**20020066354** Maryland Univ., Dept. of Materials and Nuclear Engineering, College Park, MD USA
**Colloidal Self-Assembly Phenomena**
Wilson, Otto C., Jr., Maryland Univ., USA; Martinez-Miranda, L. J., Maryland Univ., USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 587-592; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

The discovery of x-rays in the early 1900's by Bragg opened up a whole new world by providing a tool that allowed materials scientists to probe the atomic structure of crystalline materials. by definition, a crystal is a material that exhibits long range atomic order where atoms occupy specific locations on a crystal lattice. The basic building unit of a crystal is the unit cell. The unit cell is the smallest arrangement of atoms that can be translated in three dimensional space to build the crystal lattice. The basic equation that relates the atomic plane spacing (d), the wavelength of the incident radiation (lambda), and the angle of diffraction (theta) is known as Bragg's Law and can be expressed as follows: n(lambda) = 2d sin(theta).
Derived from text
*Colloids; Crystallinity; Self Assembly; Crystal Lattices*

**20020066357** Military Academy, Dept. of Civil and Mechanical Engineering, West Point, NY USA
**Development of a Deformation Processing Laboratory**
Griffin, Richard B., Military Academy, USA; Hartwig, K. Ted, Texas A&M Univ., USA; Barber, Robert, Texas A&M Univ., USA; New, Tiffany, Texas A&M Univ., USA; Karaman, Ibrahim, Texas A&M Univ., USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 617-626; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

Deformation processes have substantial effects on the mechanical properties of materials. A recent innovation called equal channel angular extrusion (ECAE) has been developed. The ECAE process forces a billet around a sharp comer and as a result large uniform simple shear strain is induced into the billet. This is opposed to the nonuniform strains associated with conventional area reduction extrusion, where a billet is forced through a die orifice. Since the die inlet and outlet chambers maintain the same cross-section in ECAE, the geometry of the billet remains the same before and after the extrusion, which allows the billet to be processed multiple times resulting in high strains. A comprehensive comparison of the effects of rolling, conventional extrusion, and ECAE has been developed into a laboratory activity for a junior level materials/manufacturing course. A comparison between deformed grid patterns of extruded copper and Play-Doh specimens from a small extrusion press are compared. Hardness measurements on deformed copper specimens are used to validate these results. Deformation is carried out at room temperature on one-inch square ECAE and one inch diameter copper bars. Explanations of the deformation processes and results from the laboratory activity are discussed.
Author
*Deformation; Manufacturing; Mechanical Properties; Pressing (Forming)*

**20020066358** Bucknell Univ., Dept. of Chemical Engineering, Lewisburg, PA USA
**BIPMAP (Binary Isomorphous Phase Map): An Interactive Computer Tool for Phase Diagram Instruction**
Csernica, Jeffrey, Bucknell Univ., USA; Stolk, Jonathan D., Bucknell Univ., USA; Hanyak, M. E., Bucknell Univ., USA; Subramanian, V., Bucknell Univ., USA; National Educators' Workshop: Update 2001: Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 627-635; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

BIPMAP, a program that can be accessed over the internet, is designed to assist with phase diagram instruction for beginning materials science students. Using a mouse and/or navigation buttons, the user can select a point anywhere in a binary isomorphous phase diagram to view information including phase amounts and compositions. Schematic alloy microstructures are also shown, which, together with corresponding color-coded phase fields, tie lines (in two-phase regions), and numerical results, help students visualize concepts such as the lever rule and microstructural development.
Author
*Microstructure; Phase Diagrams; Software Development Tools; Binary Data*

**20020066637** Defence Science and Technology Organisation, Maritime Platforms Div., Fishermans Bend, Australia
**Hull Material Selection for Replacement Patrol Boats: An Overview**
Aksu, Seref, Defence Science and Technology Organisation, Australia; Cannon, Stuart, Defence Science and Technology Organisation, Australia; Gardiner, Craig, Defence Science and Technology Organisation, Australia; Gudze, Matthew, Defence Science and Technology Organisation, Australia; January 2002; 36p; In English
Report No.(s): DSTO-TN-0410; DODA-AR-012-135; Copyright; Avail: Issuing Activity

This technical note considers the main characteristics of steel, aluminium alloys and glass fibre-reinforced composite materials in relation to the selection of primary structure for patrol boat type platforms. It is not intended to recommend or rank the suitability of candidate materials, but rather to note the main properties of each material and outline some practical considerations in relation to the construction, maintenance and military operation of patrol boats constructed from these materials.
Author
*Aluminum Alloys; Fiber Composites; Glass Fibers; Hulls (Structures); Materials Selection; Replacing*

## 24
## COMPOSITE MATERIALS

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

**20020065372** Corps of Engineers, Washington, DC USA
**Engineering and Design: Composite Materials for Civil Engineering Structures**
Stockton, Steven L.; Mar. 31, 1997; 67p; In English
Report No.(s): AD-A403282; ETL-1110-2-548; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This engineer technical letter provides basic information and references on background, evaluation, and design of fiber-reinforced plastic (FRP) materials to assist structural design engineers who are considering the use of FRP on civil works

projects. This information will help the engineer evaluate the suitability of FRP materials for structural applications, and will be useful in preparing performance specifications for procurement of suitable composite components and structures.
DTIC
*Composite Materials; Structural Engineering; Structural Design; Fiber Composites; Functional Design Specifications*

**20020065468** Naval Postgraduate School, Monterey, CA USA
**Multi-Scale Analysis of a 2/2-Twill Woven Fabric Composite**
Roach, Kevin K.; Mar. 2002; 55p; In English; Original contains color images
Report No.(s): AD-A403560; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A micro-mechanical unit-cell model was developed for 2/2-twill woven fabric composites. A multi-scale bi-directional micro/macro-mechanical analysis technique was applied to the model in an effort to estimate effective material properties of 2/2-twill composites and decompose the effective stresses (strains) of the woven fabric composite into the stresses (strains) of the lows. When this unit-cell model is incorporated into the multi-scale analysis by combining with previously developed modules, the residual strength and stiffness of a laminated structure made of 2/2-twill woven fabric composites can be predicted along with damage progression in the structure. Damage is described at the basic material units of the composite structure, the fibers and matrix. The unit-cell model and the multi-scale analysis were validated by comparing their predicted results to available data in open literature and data obtained from a finite element models.
DTIC
*Composite Materials; Fabrics; Woven Composites*

**20020065532** Building and Construction Research TNO, Centre for Maritime Engineering, Delft, Netherlands
**Tensile Tests Sonar Dome *Interim Report***
vandenEikhoff, J., Building and Construction Research TNO, Netherlands; Jan. 28, 2002; 42p; In English; Original contains color illustrations
Contract(s)/Grant(s): A01KM112/13754; TNO Proj. 006.13709/01.01
Report No.(s): TD-2001-0221; Copyright; Avail: Issuing Activity

As a preparation to the fabrication of four sonar domes for the LCF and eight for the M-frigate quasi-static pull experiments are performed on two composite T-joints. For two joints four experiments are performed according to the production specifications. It concerns joints from Holland Composites, with and without reinforcement with glass dowels. Likewise comparable T-joints from material according to the specifications of the old domes made by the Rijkswerf are tested. Holland Composites joints without dowels are somewhat stronger than the Rijkswerf joints with dowels and fail at about 36 kN/m compared to 27 kN/m. Two joints with a relatively low failure load seem to have more voids in the filler, but this cannot easily be confirmed in an objective way. Holland Composites joints with dowels are about 70% stronger than the joints without dowels. These joints fail at 61 kN/m compared to 36 kN/m without dowels. The joint with a large delamination was considerably weaker when loaded in the unfavourable direction (42 kN/m). The results of the 200 and 300 mm wide joints do not show an important difference. The joints with relative more dowels in the bend opposite of the hydraulic cylinder have somewhat larger failure loads.
Author
*Fabrication; Sonar; Mechanical Properties; Tensile Tests*

**20020065564** Sandia National Labs., Albuquerque, NM USA
**Fatigue of Composite Materials and Substructures for Wind Turbine Blades**
Mandell, J. F.; Samborsky, D. D.; Cairns, D. S.; Mar. 2002; 280p; In English
Report No.(s): DE2002-020771; SAND2002-020771; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This report presents the major findings of the Montana State University Composite Materials Fatigue Program from 1997 to 2001, and is intended to be used in conjunction with the DOE/MSU Composite Materials Fatigue Database. Additions of greatest interest to the database in this time period include environmental and time under load effects for various resin systems; large tow carbon fiber laminates and glass/carbon hybrids; new reinforcement architectures varying from large strands to prepreg with well-dispersed fibers; spectrum loading and cumulative damage laws; giga-cycle testing of strands; tough resins for improved structural integrity; static and fatigue data for interply delamination; and design knockdown factors due to flaws and structural details as well as time under load and environmental conditions. The origins of a transition to increased tensile fatigue sensitivity with increasing fiber content are explored in detail for typical stranded reinforcing fabrics. The second focus of the report is on structural details which are prone to delamination failure, including ply terminations, skin-stiffener intersections, and

sandwich panel terminations. Finite element based methodologies for predicting delamination initiation and growth in structural details are developed and validated, and simplified design recommendations are presented.
NTIS
*Carbon Fibers; Composite Materials; Wind Turbines; Fatigue (Materials)*

**20020066333** Ford Motor Co., Research Lab., Dearborn, MI USA
**P4 Preforming Technology: Process Development Utilizing Carbon Fiber Rovings**
Chavka, Norman G., Ford Motor Co., USA; Dahl, Jeffrey S., Ford Motor Co., USA; National Educators' Workshop: Update 2001: Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 287-308; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

This paper presents the Programmable Powder Preforming Process (P4) technology utilizing carbon fiber rovings.
CASI
*Carbon Fibers; Technology Utilization; Rovings; Forming Techniques; Powder (Particles)*

**20020066352** Oak Ridge National Lab., TN USA
**Carbon Fiber: The Material of the Future**
Warren, C. David, Oak Ridge National Lab., USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 525-578; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A04, Hardcopy; A06, Microfiche

The paper addresses carbon fiber as a significant composite material of the future. This paper is in viewgraph form.
CASI
*Carbon Fibers; Composite Materials; Manufacturing; Aerospace Systems*

**20020066360** National Composites Center, Kettering, OH USA
**National Composite Center and Directed Fiber Preforming**
Cordell, Tobey, National Composites Center, USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 641-654; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

This paper presents Directed Fiber Preforming applications in viewgraph form. The topics include: 1) Programmable Powdered Preform Process (P4); 2) Lower cost preforms for Lower Cost Modeling Processes; and 3) Directed Fiber Preforming (DFP) Composites.
CASI
*Fiber Composites; Preforms; Composite Materials; Powder (Particles)*

**20020066444** NASA Glenn Research Center, Cleveland, OH USA
**Thermal Gradient Cyclic Behavior of a Thermal/Environmental Barrier Coating System on SiC/SiC Ceramic Matrix Composites**
Zhu, Dongming, Ohio Aerospace Inst., USA; Lee, Kang N., Cleveland State Univ., USA; Miller, Robert A., NASA Glenn Research Center, USA; May 2002; 14p; In English; Turbo Expo 2002, 3-6 Jun. 2002, Amsterdam, Netherlands; Sponsored by American Society of Mechanical Engineers, USA
Contract(s)/Grant(s): RTOP 714-04-30
Report No.(s): NASA/TM-2002-211593; NAS 1.15:211593; E-13377; GT-2002-30632; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Thermal barrier and environmental barrier coatings (TBCs and EBCs) will play a crucial role in future advanced gas turbine engines because of their ability to significantly extend the temperature capability of the ceramic matrix composite (CMC) engine components in harsh combustion environments. In order to develop high performance, robust coating systems for effective thermal and environmental protection of the engine components, appropriate test approaches for evaluating the critical coating properties must be established. In this paper, a laser high-heat-flux, thermal gradient approach for testing the coatings will be described. Thermal cyclic behavior of plasma-sprayed coating systems, consisting of ZrO2-8wt%Y2O3 thermal barrier and NASA Enabling Propulsion Materials (EPM) Program developed mullite+BSAS/Si type environmental barrier coatings on SiC/SiC ceramic matrix composites, was investigated under thermal gradients using the laser heat-flux rig in conjunction with the furnace thermal cyclic tests in water-vapor environments. The coating sintering and interface damage were assessed by monitoring the real-time thermal conductivity changes during the laser heat-flux tests and by examining the microstructural

changes after the tests. The coating failure mechanisms are discussed based on the cyclic test results and are correlated to the sintering, creep, and thermal stress behavior under simulated engine temperature and heat flux conditions.
Author
*Sprayed Coatings; Temperature Effects; Thermal Control Coatings; Gas Turbine Engines; Ceramic Matrix Composites; Plasma Spraying*

**20020066564** NASA Marshall Space Flight Center, Huntsville, AL USA
**Developments in Hollow Graphite Fiber Technology**
Stallcup, Michael, NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; NASA Mirror Technology Days 2002, 22-24 May 2002, Huntsville, AL, USA
Contract(s)/Grant(s): NAS8-00199; No Copyright; Avail: Issuing Activity; Abstract Only

Hollow graphite fibers will be lighter than standard solid graphite fibers and, thus, will save weight in optical components. This program will optimize the processing and properties of hollow carbon fibers developed by MER and to scale-up the processing to produce sufficient fiber for fabricating a large ultra-lightweight mirror for delivery to NASA.
Author
*Carbon Fibers; Graphite; Weight Reduction*

**20020066767** Northrop Grumman Corp., USA
**Low Cost Manufacturing of Composite Cryotanks**
Meredith, Brent, Northrop Grumman Corp., USA; Palm, Tod, Northrop Grumman Corp., USA; Deo, Ravi, Northrop Grumman Corp., USA; [2002]; 13p; In English; Aerospace Manufacturing Technology Conference and Exhibition, 3-7 Jun. 2002, Hartford, CT, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This viewgraph presentation reviews research and development of cryotank manufacturing conducted by Northrup Grumman. The objectives of the research and development included the development and validation of manufacturing processes and technology for fabrication of large scale cryogenic tanks, the establishment of a scale-up and facilitization plan for full scale cryotanks, the development of non-autoclave composite manufacturing processes, the fabrication of subscale tank joints for element tests, the performance of manufacturing risk reduction trials for the subscale tank, and the development of full-scale tank manufacturing concepts.
CASI
*Cryogenic Fluid Storage; Manufacturing; Cost Reduction; Storage Tanks*

**20020067398** NASA Marshall Space Flight Center, Huntsville, AL USA
**Investigation of Structural Properties of Carbon-Epoxy Composites Using Fiber-Bragg Gratings**
Grant, J., NASA Marshall Space Flight Center, USA; Kaul, R., NASA Marshall Space Flight Center, USA; Taylor, S., NASA Marshall Space Flight Center, USA; Jackson, K., NASA Marshall Space Flight Center, USA; Sharma, A., Alabama Agricultural and Mechanical Univ., USA; [2002]; 1p; In English; Photonics North 2002 Conference, 2-6 Jun. 2002, Quebec, Canada
Contract(s)/Grant(s): RTOP 279-14-01; No Copyright; Avail: Issuing Activity; Abstract Only

Fiber Bragg-gratings are embedded in carbon-epoxy laminates as well as bonded on the surface of cylindrical structures fabricated out of such composites. Structural properties of such composites is investigated. The measurements include stress-strain relation in laminates and Poisson's ratio in several specimens with varying orientation of the optical fiber Bragg-sensor with respect to the carbon fiber in an epoxy matrix. Additionally, Bragg gratings are bonded on the surface of cylinders fabricated out of carbon-epoxy composites and longitudinal and hoop strain on the surface is measured.
Author
*Bragg Gratings; Epoxy Matrix Composites; Stress-Strain Relationships; Optical Fibers; Bragg Angle; Carbon Fibers; Poisson Ratio*

## 25
## INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

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

**20020065351** Colorado School of Mines, Dept. of Chemistry-geochemistry, Golden, CO USA
**Electronic Structure Methods for the Design of Alloy Chemistry** ***Final Report, Sep. 1999-Sep 2001***
Eberhart, Mark; Sep. 2001; 16p; In English
Contract(s)/Grant(s): F49620-00-1-0043
Report No.(s): AD-A403585; AFRL-SR-AR-TR-02-0206; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Computational materials science is a comparatively new discipline that may forever alter the way in which materials are made and improved. This discipline seeks to use modeling and simulation to predict the properties of materials that have yet to be made. It is hoped that the ever-increasing power of computation can be harnessed to aid the materials designer and thereby accelerate the pace and reduce the cost of materials development. Because the objective of this new discipline is to aid in the design of materials, its' advancement does not rely exclusively on increasingly sophisticated computational models. This advancement also requires the integration of these with traditional approaches to materials design, which make use of processing-structure-property relationships. It is argued here that the established descriptions of molecular structure and bonding can not be placed in the form of processing-structure-property relationships. Before quantum mechanical methods can be used in the discovery of such relationships, a new way to describe bonding is required. In this AFOSR funded program, such a description of the chemical bond was developed. It was shown, for specific phenomena, this new description could be used to construct processing-structure-property relationships. As these relationships were studied, it became evident that intrinsic mechanical properties are controlled by well-characterized boundaries that separate one bond from another. An understanding of how these boundaries move in response to an applied strain is necessary before it will be possible to uncover generalized relationships between the quantum mechanically determined charge density and mechanical properties.
DTIC
*Alloys; Chemical Bonds*

**20020065366** Federal Aviation Administration, Office of Aviation Research, Washington, DC USA
**Combustibility of Cyanate Ester Resins** ***Final Report***
Jun. 2002; 30p
Report No.(s): PB2002-107848; DOT/FAA/AR-02/44; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Flaming and nonflaming combustion studies were conducted on a series of polycyanurates to examine the effect of chemical composition and physical properties on the fire behavior of these cross-linked, char-forming thermoset polymers. Heats of complete combustion of the polymer and fuel gases were determined by oxygen bomb calorimetry and pyrolysis-combustion flow calorimetry, respectively. Fire calorimetry experiments were conducted to measure the heat released, the rate of heat release, and the smoke generation in flaming combustion. Fire response parameters derived from the data include the thermal inertia, heat of gasification, effective heat of combustion, and combustion efficiency. Halogen-containing polycyanurates exhibited extremely low heat release rate in flaming combustion compared to the hydrocarbon resins, yet produced significantly less smoke and comparable levels of carbon monoxide and soot.
NTIS
*Esters; Cyanates; Combustion; Combustion Efficiency; Flammability; Heat Transfer*

**20020065438** Lawrence Livermore National Lab., Livermore, CA USA
**Chemical Kinetics of Hydrocarbon Ignition in Practical Combustion Systems**
Westbrook, C. K.; Jul. 07, 2000; 52p; In English
Report No.(s): DE2002-791580; UCRL-JC-138169; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Chemical kinetic factors of hydrocarbon oxidation are examined in a variety of ignition problems. Ignition is related to the presence of a dominant chain branching reaction mechanism that can drive a chemical system to completion in a very short period of time. Ignition in laboratory environments is studied for problems including shock tubes and rapid compression machines. Modeling of the laboratory systems are used to develop kinetic models that can be used to analyze ignition in practical systems. Two major chain branching regimes are identified, one consisting of high temperature ignition with a chain branching reaction mechanism based on the reaction between atomic hydrogen with molecular oxygen, and the second based on an intermediate temperature thermal decomposition of hydrogen peroxide. Kinetic models are then used to describe ignition in practical

combustion environments, including detonations and pulse combustors for high temperature ignition, and engine knock and diesel ignition for intermediate temperature ignition . The final example of ignition in a practical environment is homogeneous charge, compression ignition (HCCI) which is shown to be a problem dominated by the kinetics intermediate temperature hydrocarbon ignition.
NTIS
*Hydrocarbons; Reaction Kinetics; Ignition; Oxidation; Hydrocarbon Combustion*

**20020065459** Air Force Office of Scientific Research, Bolling AFB, Washington, DC USA
**Combustion Instability in Laminar Boundary Layers**
Toong, Tau-Yi; Jun. 1961; 30p; In English
Contract(s)/Grant(s): AF49(638)-629
Report No.(s): AD-A403627; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This paper presents the results of two studies, aimed at understanding the basic mechanisms causing self-sustained flame oscillations. One study concerns the oscillations of a pre-mixed flame in a forced-convective boundary layer of a combustible mixture flowing over a heated surface. Another study deals with the oscillations of a diffusion flame around a simulated fuel droplet in a natural-convective boundary layer. In both cases, the results obtained indicate strongly that the onset of the self-sustained flame oscillations is due to the instability of travelling Tollmien-Schlichting waves --- the same mechanism which leads to the onset of transition from laminar to turbulent flows.
DTIC
*Combustion; Laminar Boundary Layer; Flames; Laminar Flow; Combustion Stability*

**20020065556** Argonne National Lab., IL USA
**Current Status of Dense Ceramic Membranes for Hydrogen Separation**
Balachandran, U.; Lee, T. H.; Wang, S.; Zhang, G.; Dorrius, S. E.; Feb. 2002; 16p; In English
Report No.(s): DE2002-793066; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Novel cermet (i.e., ceramic-metal composite) membranes have been developed for separating hydrogen from gas mixtures at high temperature and pressure. The hydrogen permeation rate in the temperature range of 600-900 degrees C has been measured for three classes (ANL-1, -2, and -3) of cermet membranes. ANL-3 membranes provide the highest hydrogen flux (16.2 cubic centimeters (STP)/min-sq cm for 40 use varies as m-thick ANL-3a at 900 degrees C using 100% H2 as the feed gas). The effects of membrane thickness and hydrogen partial pressure on the hydrogen flux indicate that the bulk diffusion of hydrogen is rate-limiting for ANL-3 membranes with thickness greater than 0.04 mm. ANL-3b membranes were tested in simulated syngas at several temperatures for times approaching approximately 200 h, and no degradation in performance was observed. The lack of degradation in simulated syngas suggests that the membrane is chemically stable and may be suitable for long-term operation.
NTIS
*Ceramics; Hydrogen; Membranes; Synthesis Gas; Adsorption*

**20020066247** CC Technologies Labs., Inc., Dublin, OH USA
**Procedures for Evaluating Corrosion-Inhibiting Admixtures for Structural Concrete** ***Final Report***
Thompson, N. G.; Yunovich, M.; Lankard, D. R.; Jun. 2000; 220p; In English
Report No.(s): PB2002-107447; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche
The objectives of this research were to (1) develop procedures for evaluating and qualifying corrosion-inhibiting admixtures (CIAs) and (2) recommend performance criteria for their acceptance. This research was limited to CIAs as defined in the American Concrete Institute Manual of Concrete Practice, i.e. the research was limited to chemical admixtures to be added to the portland cement concrete mixtures, usually in very small concentrations, for the primary purpose of corrosion protection. While other materials, such as microsilica, fly ash, and ground-granulated blast-furnace slag may provide corrosion protection, they were not regarded, for the purpose of this research, as CIAs. These materials, however, may be included in concrete mixtures containing CIAs.
NTIS
*Admixtures; Corrosion Prevention; Concretes*

**20020066313** Norfolk State Univ., Dept. of Chemistry, VA USA

**Electrolysis of Water in the K-12 Classroom**

Rowe, H. Alan, Norfolk State Univ., USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 27-32; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

This paper presents experiments detailing the reactions that occur when water molecules are subjected to an electrical current. CASI

*Electrolysis; Water Splitting; Education; Chemical Reactions*

**20020066345** Columbia Univ., Dept. of Chemistry, New York, NY USA

**An Instructional Software Package on FTIR Spectrometry**

Fine, Leonard W., Columbia Univ., USA; Avila, Luis, Columbia Univ., USA; Venkataraman, Bhawani, Columbia Univ., USA; National Educators' Workshop: Update 2001: Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 451-453; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A01, Hardcopy; A06, Microfiche

We have developed an interactive software package on the theory and practice of spectrometry. While the focus of the package is on an experimental technique used in chemical analysis, the mathematics, physics, and engineering of the technique are emphasized. In particular, the package illustrates how the Fourier transform and interferometry are combined to extract spectral information from interferograms. After introducing the Fourier Transform with illustrations and applications drawn from different fields (e.g. music and medicine), the software turns the user's attention to the question of how the Fourier Transform and interferometry work together in recording infrared spectrum. It starts by showing how the Michelson Interferometer is used to determine an absorption spectrum with a monochromatic light source. From there expands to a two-frequency light source and then to a polychromatic light source showing how the principles are the same, just that the interferogram gets more complex. Issues related to resolution and optimum usage of apodization functions are also discussed. Where possible, interactive animations have been included to help explain concept example, in a section contrasting a dispersive spectrometer with an FTIR spectrometer user "walks" through the instrument with the components "clickable" to view additional information or simple animations on the working principle of the component.

Derived from text

*Applications Programs (Computers); Fourier Transformation; Spectrometers; Infrared Spectra; Education*

**20020066355** National Inst. of Standards and Technology, Materials Reliability Div., Gaithersburg, MD USA

**The Magic of Cryogenics**

Vigliotti, Daniel P., National Inst. of Standards and Technology, USA; Alcorn, James B., National Inst. of Standards and Technology, USA; Marsh, Brian P., National Inst. of Standards and Technology, USA; Neumeyer, Nicole A., National Inst. of Standards and Technology, USA; National Educators' Workshop: Update 2001: Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 593-608; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

The purpose of this presentation is to introduce teachers to a demonstration that exposes K-12 students to a variety of scientific areas through experiments using liquid nitrogen. This presentation demonstrates how changing the temperature of materials changes their size and shape. During the presentation, there are many opportunities to explore subjects for which changes in temperature are important such as magnetism, biology, the relationship between pressure and volume, and the composition of air. Students may perform some of the experiments in this presentation.

Derived from text

*Cryogenics; Education; Bimetals; Superconducting Magnets*

**20020066515** NASA Marshall Space Flight Center, Huntsville, AL USA

**Steady State Sedimentation in a Liquid Fluidized Bed**

Segre, P. N., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The velocity fluctuations and the local particle concentration of a particle suspension exhibiting steady state sedimentation in a fluidized bed are determined as a function of height along the particle column. Both the velocity fluctuations and the particle volume fraction are found to strongly depend on height. We account for the stability of the bed by a simple model evoking a flux

balance. Velocity fluctuations driving a downward particle flux are compensated by an upward particle flux stemming from an excess flow velocity due to the concentration gradient of the system.
Author
*Steady State; Sediments; Fluidized Bed Processors; Flow Velocity*

**20020066617** Defence Science and Technology Organisation, Airframes and Engines Div., Fishermans Bend, Australia
**A Replacement Database for the CH-47D Spectrometric Oil Analysis Program**
Marsden, Paul, Defence Science and Technology Organisation, Australia; Becker, Andrew, Defence Science and Technology Organisation, Australia; March 2002; 80p; In English; Original contains color illustrations
Report No.(s): DSTO-TN-0412; DODA-AR-012-161; Copyright; Avail: Issuing Activity
A Spectrometric Oil Analysis Program (SOAP) operates on selected Australian Defence Force platforms to assist in the prediction of incipient machinery failure. Historically, the data from the Australian Army CH47D helicopters has been stored on a simple Microsoft Excel spreadsheet. DSTO was tasked by the Army Aircraft Logistic Management Squadron to assess the usefulness of this database. This report contains a detailed description of the replacement SOAP database designed by DSTO.
Author
*Computer Programs; Spectrometers; Oils; Analyzing*

**20020066706** NASA Ames Research Center, Moffett Field, CA USA
**Bacteriorhodopsin Material and Film Fabrication Issues for Holographic Applications**
Downie, John D., NASA Ames Research Center, USA; Timucin, Dogan A., NASA Ames Research Center, USA; Smithey, Daniel T., Bend Research, Inc., USA; Crew, Marshall, Bend Research, Inc., USA; Rayfield, George W., Oregon Univ., USA; [1998]; 1p; In English; Optical Society of America Annual Meeting, 4 - 9 Oct. 1998, Baltimore, MD, USA; Sponsored by Optical Society of America, USA
Contract(s)/Grant(s): RTOP 632-10-00; No Copyright; Avail: Issuing Activity; Abstract Only
We discuss issues associated with bacteriorhodopsin (BR) materials and films that affect optical performance in holographic applications. For the D85N variant, some critical parameters include degree of hydration and recording wavelength. The quantum efficiency of the molecular state transition is observed to be apparently dependent on the illumination wavelength. We explain this effect by modeling the photo-activity of the D85N variant as two competing photocycles between the 9-cis and 13-cis retinal configurations. We are able to determine the pure excited P-state absorbance spectrum from the ground state spectrum and mixed population spectra obtained by bleaching to steady-state conditions.
Author
*Photosensitivity; Protoproteins; Quantum Efficiency; Holography; Hydration; Photochemical Reactions; Biofilms; Fabrication*

**20020066755** Argonne National Lab., IL USA
**Numerical Study of the Impacts of Volatile Component Blending on Diesel Spray Evaporation and Combustion**
Lee, H. L.; Chang, S. L.; Petrick, M.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-42378; No Copyright; Avail: National Technical Information Service (NTIS)
A multiphase computational fluid dynamics (CFD) code is used to simulate the evaporation and combustion processes of a diesel spray blended with a highly volatile component. The CFD code uses an Eulerian approach to model the liquid phase of diesel fuel with components of different boiling temperatures. The approach divides the droplets into size groups and assigns different boiling temperatures for each group. The CFD code accounts for liquid droplet flow, turbulent mixing, interfacial drag and heat transfer, droplet evaporation and combustion, radiation heat transfer, and pollutant kinetics. Using the code, a parametric study was conducted to investigate the impacts of a volatile component on the spray evaporation and combustion characteristics. The results indicate that the blending of a highly volatile component can have an impact on droplet evaporation rate and that thermal radiation is significant in spray combustion due to the formation of soot.
NTIS
*Diesel Fuels; Evaporation; Combustion; Fuel Sprays; Spray Characteristics; Drops (Liquids); Numerical Analysis*

**20020067394** Universities Space Research Association, Huntsville, AL USA
**Interaction of Porosity with a Planar Solid/Liquid Interface**
Catalina, Adrian V., Universities Space Research Association, USA; Stefanescu, Doru M., Alabama Univ., USA; Sen, Subhayu, Universities Space Research Association, USA; Kaukler, William K., Alabama Univ., USA; Jan. 01, 2002; 1p; In English
Contract(s)/Grant(s): NCC8-66; No Copyright; Avail: Issuing Activity; Abstract Only

In this paper, an investigation of the interaction between gas porosity and a planar solid/liquid (SL) interface is reported. A two-dimensional numerical model able to accurately track sharp SL interfaces during solidification of pure metals and alloys is proposed. The finite difference method and a rectangular undeformed grid are used for computation. The SL interface is described through the points of intersection with the grid lines. Its motion is determined by the thermal and solute gradients at each particular point. Changes of the interface temperature because of capillarity or solute redistribution as well as any perturbation of the thermal and solute field produced by the presence of non-metallic inclusions can be computed. to validate the model, the dynamics of the interaction between a gas pore and a solidification front in metal alloys was observed using a state of the art X-ray Transmission Microscope. The experiments included observation of the distortion of the SL interface near a pore, real-time measurements of the growth rate and the change in shape of the porosity during interaction with an advancing SL interface in pure Al and Al-0.25 wt% Au alloy. In addition, porosity induced solute segregation patterns surrounding a pore were also quantified.
Author
*Porosity; Liquid-Solid Interfaces; Mathematical Models; Alloys*

**20020067634** NASA Marshall Space Flight Center, Huntsville, AL USA
**Technique for Determining the Viscosity and Electrical Conductivity of Semiconducting Liquids**
Li, C., Alabama Univ., USA; Scripa, R. N., Alabama Univ., USA; Ban, H., Alabama Univ., USA; Lin, B., Alabama Univ., USA; Su, C. H., NASA Marshall Space Flight Center, USA; Lehoczky, S. L., NASA Marshall Space Flight Center, USA; Feth, S., NASA Marshall Space Flight Center, USA; Zhu, S., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; (CIMTEC) International Conference on Modern Materials and Technologies, 15 Jul. 2002, Florence, Italy; No Copyright; Avail: Issuing Activity; Abstract Only

A novel apparatus for determining the viscosity and electrical conductivity of semiconducting liquids has been developed at NASA/MSFC. The apparatus is based on the transient torque technique and utilizes a 125 micrometer diameter quartz fiber as a torsion wire and a sensitive angular detector to measure the deflection angle of the crucible containing the liquid. A rotating flow is induced in the semiconducting melt by the application of a rotating magnetic field and measurement of the magnitude and transient behavior of the induced deflection angle allows the simultaneous determination of the viscosity and electrical conductivity of the melt. Measurements at room temperature and up to 900 C were made on high purity melts.
Author
*Electrical Resistivity; Liquids; Viscosity; Semiconductors (Materials); Magnetic Fields*

## 26
## METALS AND METALLIC MATERIALS

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

**20020065262** Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
**Welding of Electron Beam Single Melt Ti-6Al-4V Plate** ***Final Report, for 1997-2002***
DE Rosset, William S.; Burkins, Matthew; Roopchand, Brijmohan; May 2002; 38p; In English; Original contains color images
Report No.(s): AD-A403327; ARL-MR-539; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Single melt titanium alloy is being considered for use as armor in ground combat vehicles due to its lower cost relative to aerospace-grade material. This report examines welding issues associated with fabricating titanium alloy plate. In particular, the quality of welded single melt material was investigated as well as the possibility of out-of-position welding of standard titanium alloy. The initial results indicate that single melt material can be welded using standard techniques. Out-of-position welding can be accomplished under controlled conditions, but further process development would be needed to be able to repair titanium alloy armor in the field.
DTIC
*Titanium Alloys; Armor; Welding*

**20020065304** Corps of Engineers, Washington, DC USA
**Inspection, Evaluation, and Repair of Hydraulic Steel Structures**
Dec. 01, 2001; 133p; In English
Report No.(s): AD-A403421; USACE-EM-1110-2-6054; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This manual describes the inspection, evaluation, and repair of hydraulic steel structures, including preinspection identification of critical locations (such as fracture critical members and various connections) that require close examination. Nondestructive testing techniques that may be used during periodic inspections or detailed structural inspections are discussed.

Guidance is provided on material testing to determine the chemistry, strength, ductility, hardness, and toughness of the base and weld metal. Analyses methods that can be used to determine structure safety, safe inspection intervals, and expected remaining life of the structure with given operational demands are presented. Finally, considerations for various types of repair are discussed.
DTIC
*Nondestructive Tests; Steel Structures; Hydraulic Equipment; Weldability*

**20020065560** National Inst. of Standards and Technology, Gaithersburg, MD USA
**Novel Investigation of Iron Cross Sections via Spherical Shell Transmission Measurements and Particle Transport Calculations for Material Embrittlement Studies: Status Report**
Apr. 2000; 10p; In English
Report No.(s): DE2002-762820; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Work continues on this project, with the focus of attention directed towards optimizing the design of the experiments that we will perform. Our principle activities have been studies of the configuration of the iron sample, investigations of the source reactions to be used for the experiment with the source located within the iron sample, and on improvements in detector efficiency for determining the neutron yield as a function of angle.
NTIS
*Experiment Design; Spherical Shells; Embrittlement; Iron; Cross Sections*

**20020065567** National Inst. of Standards and Technology, Gaithersburg, MD USA
**Novel Investigation of Iron Cross Sections via Spherical Shell Transmission Measurements and Particle Transport Calculations for Material Embrittlement Studies *Quarterly Report***
Jul. 2000; 20p; In English
Report No.(s): DE2002-762821; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
We have used the DROSG-2000 code (developed by M. Drosg) to investigate neutron spectra generated by various reactions that may by utilized to generate source neutrons in our experiment: the (sup 15)N(p,n) (sup15) O and D(d,n) (sup3) He interactions. Based on our analyses, we have chosen the (sup 15)N(p,n) (sup15) O reaction as the source for neutrons with energy less than 4 MeV. Neutrons arising from this reaction are (essentially) monoenergetic for the entire energy region for which this source will be used. For the generation of higher energy neutrons (greater than 4 MeV), we have chosen the D(d,n) (sup3) He reaction. With this reaction, however, there is an accompanying background due to deuteron breakup that occurs when they strike deuterons in the target. Literature searches have revealed ways to deal with this background. This effect could also be included as an aspect of the global experimental model. For tier information see Appendix A. From the aforementioned analyses, We have obtained tie appropriate neutron spectra needed for performing the necessary neutron transport calculations needed by the project. In addition, we have procured the 1% and deuterium target gases needed for the targets, and have fabricated target cells for use in the experiments.
NTIS
*Spherical Shells; Neutron Spectra; Iron; Embrittlement*

**20020066137** Tennessee Technological Univ., Dept. of Mechanical Engineering, Cookeville, TN USA
**Hydrostatic Stress Effect On the Yield Behavior of Inconel 100**
Allen, Phillip A., Tennessee Technological Univ., USA; Wilson, Christopher D., Tennessee Technological Univ., USA; May 02, 2002; 86p; In English; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
Classical metal plasticity theory assumes that hydrostatic stress has no effect on the yield and postyield behavior of metals. Recent reexaminations of classical theory have revealed a significant effect of hydrostatic stress on the yield behavior of notched geometries. New experiments and nonlinear finite element analyses (FEA) of Inconel 100 (IN 100) equal-arm bend and double-edge notch tension (DENT) test specimens have revealed the effect of internal hydrostatic tensile stresses on yielding. Nonlinear FEA using the von Mises (yielding is independent of hydrostatic stress) and the Drucker-Prager (yielding is linearly dependent on hydrostatic stress) yield functions was performed. In all test cases, the von Mises constitutive model, which is independent of hydrostatic pressure, overestimated the load for a given displacement or strain. Considering the failure displacements or strains, the Drucker-Prager FEMs predicted loads that were 3% to 5% lower than the von Mises values. For the failure loads, the Drucker Prager FEMs predicted strains that were 20% to 35% greater than the von Mises values. The Drucker-Prager yield function seems to more accurately predict the overall specimen response of geometries with significant internal hydrostatic stress influence.
Author
*Finite Element Method; Hydrostatics; Inconel (Trademark); Plastic Properties*

**20020066248** Argonne National Lab., IL USA

**Uniaxial Creep Behavior of V-4Cr-4Ti Alloy**

Natesan, K.; Soppet, W. K.; Purohit, A.; Mar. 2002; 16p; In English

Report No.(s): DE2002-42663; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

We are undertaking a systematic study at Argonne National Laboratory to evaluate the uniaxial creep behavior of V-Cr-Ti alloys in a vacuum environment as a function of temperature in the range of 650-800 C and at applied stress levels of 75-380 MPa. Creep strain in the specimens is measured by a linear-variable-differential transducer, which is attached between the fixed and movable pull rods of the creep assembly. Strain is measured at sufficiently frequent intervals during testing to define the creep strain/time curve. A linear least-squares analysis function is used to ensure consistent extraction of minimum creep rate, onset of tertiary creep, and creep strain at the onset of tertiary creep. Creep test data, obtained at 650, 700, 725, and 800 C, showed power-law creep behavior. Extensive analysis of the tested specimens is conducted to establish hardness profiles, oxygen content, and microstructural characteristics. The data are also quantified by the Larson-Miller approach, and correlations are developed to relate time to rupture, onset of tertiary creep, times for 1 and 2% strain, exposure temperature, and applied stress.

NTIS

*Titanium Alloys; Creep Tests; Hardness; Oxygen; Vanadium Alloys; Chromium Alloys*

**20020066253** Argonne National Lab., IL USA

**Fabrication and Properties of a Tin-Lithium Alloy**

Natesan, K.; Ruther, W. E.; Apr. 2002; 18p; In English

Report No.(s): DE2002-42813; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A Sn-25 at.% Li alloy has been fabricated by starting with pure Sn and Li. The alloy was cast into various shapes and sent to researchers in several organizations in the USA and abroad for property measurements. The fabrication procedure involved gradual addition of Li from a separate vessel into a vessel that contained Sn; continuous stirring of the mixture during Li addition increased the Li content of the alloy gradually from 0 to the final value of 25 at.%. The melting temperature of the alloy was 334 C; its density was 6.36 g/cm3. Results are presented on microstructure, chemical composition, phase distribution, and microhardness of the alloy. Several experiments were conducted to evaluate the chemical reactivity of the alloy with air, water, and steam. Results showed that the alloy undergoes catastrophic oxidation when T greater than 250 C in air and develops an oxide scale in water at temperatures up to 95 C. Exposure in low-pressure steam at 200 C caused significant swelling and cracking of the alloy.

NTIS

*Lithium Alloys; Tin Alloys; Fabrication; Chemical Composition; Microstructure; Microhardness*

**20020066285** Sandia National Labs., Albuquerque, NM USA

**Fabrication of Stainless Steel Parts for MEMs**

Garino, T.; Morales, A.; Bucheit, T.; Boyce, B.; Feb. 2002; In English; This document is color dependent and/or in Landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-028075; SAND2002-8075; No Copyright; Avail: National Technical Information Service (NTIS)

A micro-molding process was used to fabricate parts in the 0.1 to 10 mm size range from a stainless steel nano-powder. The two types of molds used were both produced from parts fabricated using the LIGA process so that they had precise dimensional tolerance and straight sidewalls. Rigid PMMA molds were made by injection molding and flexible silicone rubber molds were made by casting. Mold filling was accomplished by mixing the powder with epoxy to form a putty-like material that was then pressed into the mold cavities and allowed to cure. After pyrolysis of the epoxy, the parts were sintered in forming gas. The densification kinetics were measured in situ using a video system. Full densification was achieved after 1 hour at 1350 C. The microstructure of the sintered parts was examined using the SEM. The hardness, dimensional tolerance and surface roughness of the sintered parts were also measured.

NTIS

*Stainless Steels; Fabrication; Metal Powder; Size Distribution; Surface Roughness; Injection Molding*

**20020066308** Sandia National Labs., Albuquerque, NM USA

**Mechanisms of Atmospheric Copper Sulfidation and Evaluation of Parallel Experimentation Techniques**

Barbour, J. C.; Sullivan, J. P.; Campion, M. J.; Wright, A. F.; Missert, N. A.; Mar. 2002; In English

Report No.(s): DE2002-020699; SAND2002-0699; No Copyright; Avail: National Technical Information Service (NTIS)

A physics-based understanding of material aging mechanisms helps to increase reliability when predicting the lifetime of mechanical and electrical components. This report examines in detail the mechanisms of atmospheric copper sulfidation and

evaluates new methods of parallel experimentation for high-throughput corrosion analysis. Often our knowledge of aging mechanisms is limited because coupled chemical reactions and physical processes are involved that depend on complex interactions with the environment and component functionality. Atmospheric corrosion is one of the most complex aging phenomena and it has profound consequences for the nation's economy and safety. Therefore, copper sulfidation was used as a test-case to examine the utility of parallel experimentation.
NTIS
*Sulfidation; Copper; Evaluation; Atmospheric Effects; Aging (Materials)*

**20020066318** Naval Academy, Dept. of Mechanical Engineering, USA
**Room Temperature Creep of Pb-Sn and Sn-Ag-Cu Eutectic Solders**
Osborne, Matthew C., Naval Academy, USA; Hurley, Monica, Naval Academy, USA; Moran, Angela L., Naval Academy, USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 75-85; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

This laboratory experiment is designed to provide students with a fundamental understanding of time-temperature-load behavior of materials, and the creep behavior of two similar metal alloys.
Derived from text
*Creep Properties; Eutectics; Room Temperature; Solders; Lead (Metal); Tin Alloys*

**20020066320** Kettering Univ., Manufacturing Engineering, Flint, MI USA
**Experiments for First Year Engineering Students using Sn-Bi Alloys**
Palmer, Mark A., Kettering Univ., USA; Wainwright, Kurt, Virginia Commonwealth Univ., USA; Fok, Lung C., Virginia Commonwealth Univ., USA; Jones, Benjamin, Virginia Commonwealth Univ., USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 95-103; In English; Also announced as 20020066311
Contract(s)/Grant(s): NSF DUE-99-80982; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

An introductory course, the completion of which will enable first year students to make design decisions based on experimental data and using their knowledge of structure and processing identify possible alternative materials has been developed at VCU and RPI. The order of topics selected for this course is based on the paradigm that Processing effects Structure which effects Properties which in turn determines Performance and is the basis for design. To make this course successful laboratory experiments and hands-on exercises have been incorporated into the studio-based recitation which is the key learning experience. Alloys based on Sn and Bi have been used to demonstrate eutectic melting and diffusion in the solid and liquid states: 1) validate the Sn-Bi phase diagram through determination of the amount of proeutectic constituent; 2) demonstrate coarsening of second phase particles; 3) demonstrate sintering using Sn-Bi solder paste; and 4) demonstrate grain growth using Sn. The success of these experiments/demonstrations and how they were integrated into a course without a separate lab or lab grade will be discussed. This was funded by the National Science Foundations' CCLI Program.
Author
*Eutectics; Solders; Tin Alloys; Bismuth Alloys*

**20020066332** Loyola Coll., Dept. of Electrical Engineering and Engineering Science, Baltimore, MD USA
**Characterizing Alloy Microstructures for Semi-Solid Forming**
Pond, Robert B., Jr., Loyola Coll., USA; Hornung, Scott N., Lucent Technologies, USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 277-285; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

Properties of alloys are dependent on microstructure. The three dimensional characterization of microstructure, although important is not often developed in a laboratory course, because the acquisition and processing of data is usually time consuming and expensive. However, three-dimensional microstructure characterizations can be easily made within the scope of a senior engineering project. In this case a commercial semi-solid forming aluminum- 7.0 silicon- 0.5 magnesium alloy was used (A357. 0) (Figure One (2)). This alloy was of interest because the thixotropic properties of the alloy when heat-treated in the liquid plus solid phase field are dependent on the size, shape, fraction solids, and interconnections between the primary phase particles. This laboratory exercise provides an easy method to examine three-dimensional microstructures and specifically to measure and characterize the microstructures of an aluminum-silicon-magnesium hypoeutectic alloy used for commercial semi-solid forming. 1. A specimen is heat treated and prepared for metallography. 2. The specimen surface is indexed with three microhardness

indentations and successively polished and etched. 3. The microstructural data is digitized and analyzed using NIH Image (3) software to present and measure the nature of the microstructure.
Author
*Metallography; Microstructure; Eutectic Alloys; Semisolids*

**20020066336** California Univ., Dept. of Chemical Engineering and Materials Science, Davis, CA USA
**Luder's Band Formation in Steel**
Meier, Mike, California Univ., USA; Broumas, Aaron, California Univ., USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 333-342; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

Luders bands formation and propagation are fascinating aspects of the deformation of a number of materials. This can be seen in figure 1 as the curious feature of the stress-strain curve, the upper and lower yield strengths and yield point extension. This behavior is characterized by an initially high yield stress followed immediately by a sudden drop in stress. With continued straining the stress stays nearly constant for several percent strain before normal strain hardening behavior begins. This behavior always elicits questions from students. An explanation involves a discussion that deals with how dislocations break free of the solute atoms, a localized process which produces the Luders bands which in turn propagate until they cover the whole specimen. Luders bands may appear as elongated surface markings or depressions, often visible with the unaided eye. Many textbooks contain pictures of Luders bands we can show to the students, or, we can polish up a specimen and let the students watch the Luders bands from during a tensile test. If this is not convenient then one can use our video that shows Luders bands forming and propagating on the surface of a polished steel tensile specimen. In this video project, specimens of steel were annealed, polished and tensile tested. Changes in the surface of a specimen observed using an optical microscope were recorded using a VCR and a PC-based digital video capture system. In this paper we describe how this was done.
Derived from text
*Steels; Digital Television; Mechanical Properties; Plastic Deformation*

**20020066350** National Inst. of Standards and Technology, Gaithersburg, MD USA
**Hardness Indentation Analysis**
Fields, Richard J., National Inst. of Standards and Technology, USA; Pierce, Thomas A., Norfolk State Univ., USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 505-508; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A01, Hardcopy; A06, Microfiche

Hardness is measured by forcing a hard sphere or diamond brale into a surface using a known load; the size (area or depth) of the resulting indentation is a measure of the hardness. The hardness is related to other mechanical properties. The ease and speed of hardness testing makes it the measurement of choice by industry, especially for quality control. Besides simply characterizing the hardness of a product, hardness testing can be used to analyze structures. For example, it can be used to find welds in structures and to determine if some regions are brittle. Its value is affected by residual stresses in metals and it is the purpose of this experiment to show this effect.
Derived from text
*Hardness Tests; Mechanical Properties; Metals; Residual Stress; Indentation*

**20020066393** IAP Research, Inc., Dayton, OH USA
**Putting the Pressure On**
Spinoff 2000; 2000, pp. 81; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

Langley Research Center's interest in hypersonic flight led to a SBIR contract with IAP Research, Inc. to develop an electromagnetic launcher. The launcher technology was the basis for IAP's Magnepress process which manufactures high-density parts at rapid rates. The powder compaction technology can be used in the automotive industry and has also been sold to ice cream dispenser manufacturers.
Author
*Technology Utilization; Manufacturing; Powder (Particles); Pressing (Forming); Magnetic Compression*

**20020066462** Argonne National Lab., Material Science Div., IL USA

**Mossbauer Effect Study of the Fe Spin Structure in Exchange-Bias and Exchange-Spring Systems**

Keune, W.; Kuncser, V. E.; Jiang, J. S.; Bader, S. D.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-793068; No Copyright; Avail: National Technical Information Service (NTIS)

Theoretical and experimental issues connected with exchange-bias and exchange-spring behavior are briefly reviewed, and the potential of conversion electron Moessbauer spectroscopy (CEMS), including the (sup 57)Fe probe layer technique, to reveal the spin structure in layered systems is emphasized. First experimental results are reported for the new exchange-bias system FeSn(sub 2)/Fe and for the exchange-spring system Sm-Co/Fe.

NTIS

*Magnetic Materials; Iron 57; Mossbauer Effect; Spin Exchange*

**20020066470** NASA Marshall Space Flight Center, Huntsville, AL USA

**Structural Fluctuations and Thermophysical Properties of Molten II-VI Compounds**

Su, Ching-Hua, NASA Marshall Space Flight Center, USA; Zhu, S., Universities Space Research Association, USA; Li, C., Alabama Univ., USA; Scripa, R., Alabama Univ., USA; Lehoczky, S. L., NASA Marshall Space Flight Center, USA; Kim, Y. M., Alabama Univ., USA; Baird, J. K., Alabama Univ., USA; Lin, B., Alabama Univ., USA; Ban, H., Alabama Univ., USA; Benmore, Chris, Argonne National Lab., USA; [2002]; 1p; In English; 2002 NASA Materials Science Conference, 25-26 Jun. 2002, Huntsville, AL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The objectives of the project are to conduct ground-based experimental and theoretical research on the structural fluctuations and thermophysical properties of molten II-VI compounds to enhance the basic understanding of the existing flight experiments in microgravity materials science programs as well as to study the fundamental heterophase fluctuation phenomena in these melts by: 1) conducting neutron scattering analysis and measuring quantitatively the relevant thermophysical properties of the II-VI melts (such as viscosity, electrical conductivity, thermal diffusivity and density) as well as the relaxation characteristics of these properties to advance the understanding of the structural properties and the relaxation phenomena in these melts and 2) performing theoretical analyses on the melt systems to interpret the experimental results. All the facilities required for the experimental measurements have been procured, installed and tested. Thermal diffusivity of molten tellurium has been measured by a laser flash method in the temperature range of 500 C to 900 C. The measured diffusivity as a function of temperature agrees fairly well with published data. However, a relaxation phenomenon, which shows a slow drift of the measured thermal conductivity toward the equilibrium value after cooling of the melt, was observed for the first time. An apparatus based on the transient torque induced by a rotating magnetic field has been developed to determine the viscosity and electrical conductivity of semiconducting liquids. Viscosity measurements on molten tellurium showed a similar relaxation behavior to the measured diffusivity. The density and volume expansion coefficients for pure Te and HgTe melts were measured as a function of temperature using a pycnometric method. A density maximum was found for both melts but no relaxation behavior was observed. Neutron scattering experiments were performed on the HgTe and HgZnTe melts and the results on pair distribution showed better resolution than previously reported. A simple kinetic theory, which contains the formation reactions of Te polymerization that increases the molecular weight, was proposed to interpret the relaxation behavior of HgZnTe viscosity data.

Author

*Mercury Tellurides; Thermophysical Properties; Structural Analysis; Metalloids; Thermal Diffusivity*

**20020066487** National Aerospace Lab., Amsterdam, Netherlands

**Brittle Archaeological Silver Identification, Restoration and Conservation**

Wanhill, R. J. H.; Jan. 13, 1998; 26p; In English

Report No.(s): PB2002-105885; NLR-TP-97647-L; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Archaeological silver can be brittle and may be found cracked or fragmented. The brittleness is a long term consequence of corrosion and microstructural changes, acting separately or together. This paper presents current knowledge of the embrittling mechanisms, factors contributing to the types and severity of embrittlement, and possibilities for restoration and conservation.

NTIS

*Archaeology; Brittleness; Microstructure; Restoration; Silver*

**20020066521** Boeing Aerospace Co., Huntington Beach, CA USA

**Assessment of Al-Li Alloys for Cryotanks**

Babel, Henry W., Boeing Aerospace Co., USA; Bozich, William, Boeing Aerospace Co., USA; Farahmand, Bob, Boeing Aerospace Co., USA; DeJesus, Ron, Boeing Aerospace Co., USA; Sankaran, K. K., Boeing Aerospace Co., USA; Schwab, Dave,

Boeing Aerospace Co., USA; Tarkanian, Mike, Boeing Aerospace Co., USA; Jun. 13, 2002; 14p; In English; AeroMat 2002, 10-13 Jun. 2002, Orlando, FL, USA
Contract(s)/Grant(s): NAS8-01099; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This viewgraph presentation provides information on steps undertaken to determine the suitability of Aluminum and Lithium alloys in cryogenic tank construction. Major characteristics are offered for several different candidate alloys including reliability, weldability, flammability, and required thicknesses.

CASI

*Aluminum Alloys; Cryogenic Fluid Storage; Lithium Alloys; Materials Selection*

**20020066529** Geological Survey, Reston, VA USA

**Chromium Recycling in the USA in 1998**

Papp, J. F.; 2002; 20p

Report No.(s): PB2002-107873; CIRC-1196-C; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this report is to illustrate the extent to which chromium was recycled in the USA in 1998 and to identify chromium-recycling trends. The major use of chromium was in the metallurgical industry to make stainless steel; substantially less chromium was used in the refractory and chemical industries. In this study, the only chromium recycling reported was that which was a part of stainless steel scrap reuse. In 1998, 20 percent of the U.S. apparent consumption of chromium was secondary (from recycling); the remaining 80 percent was based on net chromium commodity imports and stock adjustments. Chromite ore was not mined in the USA in 1998.

NTIS

*Chromium; Recycling; USA; Minerals; Metallurgy*

**20020066644** NASA Marshall Space Flight Center, Huntsville, AL USA

**Triggered Nucleation in Ni60Nb40 Using an Electrostatic Levitator**

Rathz, T., Alabama Univ., USA; Robinson, M. B., NASA Marshall Space Flight Center, USA; Hyers, R. W., NASA Marshall Space Flight Center, USA; Rogers, J. R., NASA Marshall Space Flight Center, USA; Li, D., Westcast Industries, Inc., USA; [2002]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

External triggering of nucleation in an undercooled liquid metal has been performed for the first time in an electrostatically levitated sample of undercooled eutectic Ni60Nb40. With the Electrostatic Levitator (ESL) facility at NASA/MSFC, NiNb alloys were externally nucleated at various undercooling increments. Observation of the resulting microstructure indicates that only one nucleation site is initiated with a trigger if the undercooling is sufficiently high. Well-defined transition zones exist in all the samples. An ”anomalous” fine structured eutectic is initially grown from the nucleation point into the undercooled liquid followed by an unexpected variable width transition zone leading to a coarse structured region of dendrites. Our study tends to corroborate the findings of other studies on highly undercooled eutectics regarding a coupled growth zone within which the lamellar structure is formed and outside of which the anomalous is found.

Author

*Electrostatics; Eutectics; Levitation; Nucleation; Supercooling*

**20020066652** NASA Marshall Space Flight Center, Huntsville, AL USA

**Studies of Nucleation and Growth, Specific Heat and Viscosity of Undercooled Melts of Quasicrystals and Polytetrahedral-Phase-Forming Alloys**

Kelton, K. F., NASA Marshall Space Flight Center, USA; Gangopadhyay, A. K., NASA Marshall Space Flight Center, USA; Lee, G. W., NASA Marshall Space Flight Center, USA; Hyers, R. W., NASA Marshall Space Flight Center, USA; Rogers, J. R., NASA Marshall Space Flight Center, USA; Robinson, M. B., NASA Marshall Space Flight Center, USA; Rathz, T. J., NASA Marshall Space Flight Center, USA; Krishnan, S., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 2002 NASA Materials Science Conference, 25-26 Jun. 2002, Huntsville, AL, USA; Sponsored by NASA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The local atomic structures of undercooled liquid metals are presumed to be icosahedral; this order is incompatible with translational periodicity, constituting a barrier to the nucleation of the crystal phase. The extended atomic structure of the icosahedral quasicrystal (i-phase) is similar to that presumed in the undercooled liquid. Therefore, a comparison of the maximum undercooling in alloys that form the i-phase with those that form crystal phases provides a probe of the liquid structure.

Author

*Liquid Metals; Melts (Crystal Growth); Nucleation; Specific Heat; Supercooling; Viscosity*

**20020066653** NASA Marshall Space Flight Center, Huntsville, AL USA

**Origin of the Large Bandgap Bowing in Highly Mismatched Semiconductor Alloys**

Wu, J., California Univ., USA; Walukiewicz, W., California Univ., Lawrence Berkeley National Lab., USA; Yu, K. M., California Univ., Lawrence Berkeley National Lab., USA; Ager, J. W., III, California Univ., Lawrence Berkeley National Lab., USA; Haller, E. E., California Univ., Lawrence Berkeley National Lab., USA; Miotkowski, I., Purdue Univ., USA; Ramdas, A. K., Purdue Univ., USA; Su, Ching-Hua, NASA Marshall Space Flight Center, USA; Sou, I. K., Hong Kong Univ. of Science and Technology, Hong Kong; Perera, R., California Univ., Lawrence Berkeley National Lab., USA; [2002]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

We use a combination of optical and soft x-ray fluorescence techniques to investigate the composition dependence of the band edge energies in ZnSe(1-x)Te(x) and ZnS(1-x)Te(x) alloys. The results reveal entirely different origins of the large bandgap bowing for alloys with small and large Te content. On the Te-rich side, the reduction of the bandgap is well explained by the band anticrossing interaction between the Se or S localized states and the ZnTe conduction band states. On the Se or S-rich side, an interaction between the localized Te states and the degenerate GAMMA valence bands of ZnSe or ZnS is responsible for the bandgap reduction and the rapid increase of the spin-orbit splitting with increasing Te concentration. Results of soft x-ray fluorescence experiments provide direct evidence for the valence band anticrossing interaction. The bandgap bowing over the entire composition range is accounted for by a linear interpolation between the conduction band anticrossing and valence band anticrossing models.

Author

*Conduction Bands; Energy Gaps (Solid State); Semiconductors (Materials); Alloys*

**20020067393** NASA Marshall Space Flight Center, Huntsville, AL USA

**Laminar-Turbulent Transition in an Electromagnetically-Levitated Droplet**

Hyers, Robert W., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

During experiments on the MSL-1 (First Microgravity Science Laboratory) mission of the Space Shuttle (STS-83 and STS-94, April and July 1997), a droplet of palladium-silicon alloy was electromagnetically levitated for viscosity measurements. For the non-deforming droplet, the resultant MHD flow inside the drop can be inferred from motion of impurity particulates on the surface. In the experiments, subsequent to melting, Joule heating produces a continuous reduction of viscosity of the fluid resulting in an acceleration of the flow with time. These observations indicate formation of a pair of corotating toroidal flow structures inside the spheroidal drop that undergo flow instabilities. As the fluid temperature rises, the amplitude of the secondary flow increases; and beyond a point, the tracers exhibit non-coherent chaotic motion signifying emergence of turbulence inside the drop. Assuming that the observed laminar-turbulent transition is shear-layer type, the internal structure of the toroidal loops is used to develop a semi-empirical correlation for the onset of turbulence. Our calculations indicate that the suggested correlation is in modest agreement with the experimental data, with the transition occurring at a Reynolds number of 600.

Author

*Turbulent Boundary Layer; Boundary Layer Transition; Laminar Flow; Magnetohydrodynamic Flow; Palladium Alloys; Silicon Alloys; Drops (Liquids)*

**20020067397** NASA Marshall Space Flight Center, Huntsville, AL USA

**A New Analytical Approach to Predict Spacing Selection in Lamellar and Rod Eutectic Systems**

Catalina, Adrian V., Universities Space Research Association, USA; Sen, Subhayu, Universities Space Research Association, USA; Stefanescu, D. M., Alabama Univ., USA; [2002]; 1p; In English

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

The Jackson and Hunt (JH) theory has been modified to relax the assumption of isothermal solid/liquid interface(SLI) used in their treatment. Based on the predictions of this modified theory the traditional definitions of regular and irregular eutectics are revised. For regular eutectics the new model identifies a range of spacing within the limits defined by the minimum undercooling of the alpha and beta phase. For the irregular Al-Si eutectic system two different spacing selection mechanisms were identified: a) for a particular growth rate, a nearly isothermal interface can be achieved at a unique minimum spacing lambda(sub I); b) the average spacing (lambda(sub av) greater than lambda(sub I)) is essentially dictated by the undercooling of the faceted phase. Based on the modified theoretical model a semiempirical expression has been developed to account for the influence of the temperature gradient, which is dominant in the irregular Al-Si system. The behavior of the Fe-Fe3C eutectic is also discussed The theoretical calculations have been found to be in good agreement with the published experimental measurements.

Author

*Eutectics; Mathematical Models; Spacing; Predictions*

**20020067451** NASA Marshall Space Flight Center, Huntsville, AL USA

**Flight Planning for the International Space Station-Levitation Observation of Dendrite Evolution in Steel Ternary Alloy Rapid Solidification**

Flemings, M. C., NASA Marshall Space Flight Center, USA; Matson, D. M., NASA Marshall Space Flight Center, USA; Loser, W., NASA Marshall Space Flight Center, USA; Hyers, R. W., NASA Marshall Space Flight Center, USA; Rogers, J. R., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 2002 NASA Materials Science Conference, 25-26 Jun. 2002, Huntsville, AL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The paper is an overview of the status and science for the LODESTARS (Levitation Observation of Dendrite Evolution in Steel Ternary Alloy Rapid Solidification) research project. The program is aimed at understanding how melt convection influences phase selection and the evolution of rapid solidification microstructures.

Author

*Melts (Crystal Growth); Flight Plans; Levitation Melting; International Space Station*

## 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.*

**20020065295** Space and Naval Warfare Systems Center, San Diego, CA USA

**Material and Acoustical Studies of Elastic Protein-Based Polymers Engineered for Selected Acoustical and Non-Acoustical Characteristics** ***Final Report, 1 Oct. 1998-30 Sep. 1999***

Dea, Jack Y.; Sheiba, Lev; Jun. 24, 2002; 3p; In English

Contract(s)/Grant(s): N00014-99-WX-20344

Report No.(s): AD-A403518; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Elastic protein-based polymers have been synthesized. These are solid materials having been cross-linked by gamma-ray irradiation. Three of these samples have been measured. The results show that their elastic properties are different from traditional rubbers and polyurethanes. Typical absorbent materials have loss factors that rise with increase in frequency and a shear modulus that is relatively flat with frequency. On the other hand, the protein-based polymers have large loss factors at low frequencies, have loss factor that decrease with frequency, and have shear modulus that sharply increase at the high frequency end. These results demonstrate that these new materials hold great promise in their application as materials for broad band anechoic coatings for ships and submarines.

DTIC

*Polymers; Acoustic Properties*

**20020065550** Praxair, Inc., Tonawanda, NY USA

**Ceramic Membrane Enabling Technology for Improved IGCC Efficiency** ***Annual Report, Oct. 2000 - Oct. 2001***

Prasad, R.; Oct. 2001; 12p; In English

Report No.(s): DE2002-793317; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This yearly technical progress report will summarize work accomplished for Phase 1 Program during the program year 2000/2001. In task 1, the lead material composition was modified to enable superior fluxes and its mechanical properties improved. In task 2, composite OTM elements were fabricated that enable oxygen production at the commercial target purity and 75% of the target flux. In task 3, manufacturing development demonstrated the technology to fabricate an OTM tube of the size required for the multitube tester. The work in task 4 has enabled a preferred composite architecture and process conditions to be predicted. In task 5, the multi-tube reactor is designed and fabrication almost complete.

NTIS

*Ceramics; Technology Utilization; Manufacturing; Mechanical Properties*

**20020066129** Media and Process Technology, Inc., Pittsburgh, PA USA

**CO2 Selective Ceramic Membrane for Water-Gas Shift Reaction with Concomitant Recovery of CO(2). Quarterly Report for the Period July 2001-September 2001** ***Quarterly Report, Jul. - Sep. 2001***

Liu, P. K. T.; Oct. 03, 2001; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-794136; No Copyright; Avail: National Technical Information Service (NTIS)

This quarterly report focuses on the two specific topics: Reversibility of CO2 affinity of hydrotalcite materials; In-situ crystallization of hydrotalcite on commercial tubular ceramic membrane as substrate. The former relates to the foundation of the use of the hydrotalcite material as a membrane. The later addresses the first step of the membrane synthesis we propose. Our study concludes that the CO2 affinity of the hydrotalcite material is reversible at 150 C and in the presence of water using TG/MS (thermogravimetry/ mass spectrometry). Additional study at a high pressure and/or high temperature will be performed to scope the operating range of the membrane. On the other hand, the in-situ crystallization is proven to be an effective first step for the hydrotalcite membrane synthesis. Our result indicates that hydrotalcite covers about 50% of the porosity of the substrate, ideal as a seed for the 2nd step involving in situ crystal growth. Our next quarterly report will report the result from the study on the second step.
NTIS
*Membranes; Carbon Dioxide; Ceramics; Gas Recovery*

**20020066329** College of Western New England, Cape Elizabeth, MA USA
**Experiments in Electrically and Magnetically Active Polymers: Not Just Insulating Plastics**
Masi, James V., College of Western New England, USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 241-256; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

The advent of organic materials for electroluminescent devices has allowed a wide variety of applications in displays, communications, sensors, and the like. The demonstration of organic magnetic materials has offered the challenge of finding polymer (organic) materials in which there is sufficient electronic exchange as well as stability in both thermally and chemically. The intrinsically conductive and semiconductive polymers have allowed designers the liberties of flexibility and conductivity to meet needs from batteries to solar cells. This paper gives an overview of this search past, present, and future and the synthesis of promising new complex polymer building blocks which can yield conductive, semiconductive, luminescent, ferro-, ferri-, and super-paramagnetic materials for devices of the future in power, storage, displays, and communications devices. The use of these materials to produce electrically active polymeric materials has changed our way of thinking about how to fabricate devices with properties heretofore unrealizable.
Author
*Electroluminescence; Insulation; Organic Materials; Polymers; Plastics; Molecular Electronics*

**20020066337** Maryland Univ., Dept. of Materials and Nuclear Engineering, College Park, MD USA
**Transmission Electron Microscopy of Self-Organized Magnetic Structures in La(0.67)SR(0.33)Mn Films**
Salamanca-Riba, Lourdes, Maryland Univ., USA; Martinez-Miranda, L. J., Maryland Univ., USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 343-349; In English; Also announced as 20020066311
Contract(s)/Grant(s): NSF DMR-00-80008; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

La(1-x), SR(x)MnO3 (LSMO) is a magnetic oxide that shows a very large change in its electrical resistance in the presence of a magnetic field. The elements in the LSMO are ionic, namely, La(3+), SR(2+), a mixture of Mn(3+) and Mn(4+), and O(2-). The properties of the LSMO depend on the Mn(3+)/Mn(4+) ratio, which can in turn be controlled by the La(3+)/SR(2+) ratio and the oxygen content. to obtain films with desirable properties it is necessary to control the composition of the LSMO. In this project the structure of LSMO films grown by pulsed laser deposition on LaAlO3 substrates is studied for the characterization of a two-phase material. During the deposition of the films the LSMO transforms into two phases. The transformation takes place by phase separation in the form of self-assembled structures. One phase consists of columns of MnO with square base that extend from the film/substrate interface to the film surface embedded in a matrix of LSMO (second phase). The MnO remains epitaxial with the matrix and with the LaAlO3 substrate. The columns have a different structure (cubic, a =0.445 nm)) from the LSMO matrix (tetragonal, a =038 nm, c=1.32 nm) in which the out-of plane interplanar distance of the LSMO and that of the MnO are approximately the same. In contrast, the in-plane interplanar spacings are different giving rise to in-plane misfit dislocations between the MnO and the LSMO. This exercise is carried out after the students in the class have performed a standard x-ray diffraction experiment so that they are already familiar with Bragg's Law, Miller indices, and the concept of diffraction in general. In this project, electron diffraction patterns are obtained from the LSMO film and substrate. The pattern from the substrate is used for calibration. Images are obtained using objective apertures of different sizes to include the transmitted or direct (BF) beam only, a diffracted (DF) beam only, the transmitted and several diffracted beams at the same time.
Derived from text
*Magnetic Field Configurations; Transmission Electron Microscopy; X Ray Diffraction; Metal Films; Manganese; Strontium; Lanthanum*

**20020066356** University of North Texas, Dept. of Materials Science, Denton, TX USA

**Molecular Dynamics Simulations of Cracking Phenomena in Polymer Liquid Crystals (PLCs)**

Brostow, Witold, University of North Texas, USA; Cunha, Antonio M., Minho Univ., Portugal; Simoes, Ricardo, University of North Texas, USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 609-616; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

Reliability of polymeric materials is important not only for scientists and engineers, but also for all the users of these materials, that is, for all of us. The users do not know about the chemistry of synthesis, processing, thermodynamics, or rheology. However, when buying a product that contains polymeric components, they want appropriate quality assured. Although mechanics of polymers exists for quite some time, there are still no answers to fundamental questions such as: "where does a crack begin" or "how does it grow". Scanning electron microscopy (SEM) allows us to study the surface of cracks after fracture has occurred; however, it provides no information to answer the questions above. For obvious reasons these issues are important also for students of Materials Science and Engineering (MSE) and related disciplines. There is by far not enough about computer modeling and simulations in MSE textbooks. An approach exists to answer these questions: computer simulations. One can create a polymeric material on a computer, apply an external force to it, and observe how cracks form, how they propagate through the material, and how fracture eventually occurs. A particular problem with computer simulations is the large amount of information they produce. Effective methods to analyze this information are therefore needed. The solution found was three-dimensional (3D) graphical representation of the results through OpenGL rendering.

Derived from text

*Computerized Simulation; Liquid Crystals; Molecular Dynamics; Polymers; Crack Propagation*

**20020066440** Advanced Silicon Materials, Inc., Moses Lake, WA USA

**Cleaning up Silicon**

Spinoff 2000; 2000, pp. 82; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

A development program that started in 1975 between Union Carbide and JPL, led to Advanced Silicon Materials LLC's, formerly ASiMI, commercial process for producing silane in viable quantities. The process was expanded to include the production of high-purity polysilicon for electronic devices. The technology came out of JPL's Low Cost Silicon Array Project.

Author

*Technology Utilization; Silanes; Silicon Polymers; Manufacturing; Silicon*

**20020066441** GeoTech Chemical Co., LLC, Tallmadge, OH USA

**Papering Over Corrosion**

Spinoff 2000; 2000, pp. 79; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

Kennedy Space Center's battle against corrosion led to a new coating that was licensed to GeoTech and is commercially sold as Catize. The coating uses ligno sulfonic acid doped polyaniline (Ligno-Pani), also known as synthetic metal. Ligno-Pani can be used to extend the operating lives of steel bridges as one example of its applications. future applications include computers, televisions, cellular phones, conductive inks, and stealth technology.

Author

*Technology Utilization; Corrosion Prevention; Protective Coatings; Synthetic Metals*

**20020066468** Deformation Control Technology, Inc., Cleveland, OH USA

**Cool Software for Hot Materials**

Spinoff 2000; 2000, pp. 74; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

Deformation Control Technology, Inc. (DCT) used a NASA SBIR contract to develop a computer modeling system for evaluating thermal barrier coatings (TBCs) beforehand. Traditional tests of TBCs required Burner Rig tests, which involved the actual application of a coating to a surface. DCT's software reduces experimentation costs as well as led to a breakthrough in understanding the role of bond coat oxidization. DCT's method has been used in a variety of turbine applications.

Author

*Technology Utilization; Computerized Simulation; Thermal Control Coatings; Computer Aided Design; Applications Programs (Computers)*

**20020066516** NASA Marshall Space Flight Center, Huntsville, AL USA

**Computer Models of Micrometeoroid Impact on Fused Silica Glass Mirrors**

Davison, David, Shock Transients, Inc., USA; Cour-Palais, Burton, CourPalais (Burton), USA; Quan, X., Century Dynamics Ltd., UK; Holmquist, T. J., Network Computing Services, Inc., USA; Cohen, Lester, Smithsonian Astrophysical Observatory, USA; Ramsey, Ron, Auburn Univ., USA; Cummings, Ramona, NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 2nd Annual Technology Days, 22-24 May 2002, Huntsville, AL, USA

Contract(s)/Grant(s): NCC8-200; No Copyright; Avail: Issuing Activity; Abstract Only

For the first (low energy) calculation both the particle and crater parameters (from tests at AU/HIF) were known, For the second (high energy) calculation, only the particle parameters were known. In both cases the computed craters agreed with historical data of impact on glass. Additional tests at AU/HIF are expected to confirm the results of the second calculation and to validate the technique for use at higher velocities.

Author

*Computerized Simulation; Micrometeoroids; Mirrors; Silica Glass; Mathematical Models*

**20020066522** Southwest Texas State Univ., Dept. of Chemistry, San Marcos, TX USA

**Low Dielectric Polymers** ***Annual Report, 10 May 2001 - 9 May 2002***

Venumbaka, Sreenivasulu R., Southwest Texas State Univ., USA; Cassidy, Patrick E., Southwest Texas State Univ., USA; [2002]; 10p; In English

Contract(s)/Grant(s): NCC1-01033; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This report summarizes results obtained from research funded through Research Cooperative Agreement No. NCC-1-01033-"Low Dielectric Polymers" (from 5/10/01 through 5/09/02). Results are reported in three of the proposed research areas (Tasks 1-3 in the original proposal): (1) Repeat and confirm the preparation and properties of the new alkyl-substituted PEK, 6HC17-PEK, (2) Prepare and evaluate polymers derived from a highly fluorinated monomer, and (3) Prepare and evaluate new silicon and/or fluorine-containing polymers expected to retain useful properties at low temperature.

Author

*Polymers; Low Temperature; Dielectrics; Alkyl Compounds*

**20020066613** California Univ., Lawrence Berkeley National Lab., Berkeley, CA USA

**Synthesis, Properties and Applications of Pure and Covalently Doped DLC Films Prepared by Energetic Condensation**

Monteiro, O. R.; Nov. 2001; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-793752; LBNL-48667; No Copyright; Avail: National Technical Information Service (NTIS)

Hyper-thermal species have been used to produce carbon-based films with mechanical and tribological properties that have greatly expanded the applications of amorphous carbon coatings. Tetragonally bonded amorphous carbon films have properties that approach that of diamond in several ways. The major drawback, namely intrinsic stresses, preventing the production of thick ta-C films has been overcome by heat treating these films, and presently several micrometer-thick films of ta-C are regularly produced. Yet another area where superhard coatings are of great interest is for wear applications at elevated temperatures, namely around 500 degrees C and above. Such temperatures may be environment temperatures, or localized (flash) temperatures resulting for instance from wear. For this applications, doping the ta-C with elements that are covalently bonded to C (such as Si and B) offers a promising alternative. In this article, I will discuss some treatments that have allowed expanding the applications of pure ta-C, and the incorporation of Si and B on ta-C films. Film properties are presented and discussed.

NTIS

*Carbon; Synthesis (Chemistry); Mechanical Properties; Thick Films; Coatings; Doped Crystals; Tribology*

**20020066618** Media and Process Technology, Inc., Pittsburgh, PA USA

**CO(2) Selective Ceramic Membrane for Water-Gas Shift Reaction with Concomitant for the Recovery of CO(2)** ***Quarterly Report, Jan. - Mar. 01***

Liu, P. K. T.; Apr. 09, 2001; 12p; In English

Report No.(s): DE2002-794134; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The study in the previous quarterly report suggested the possibility that hydrotalcite crystals in the neighborhood of 0.2 micrometers or greater are immediately formed when the two solutions are combined together. The conventional approach (such as methods developed for the zeolitic membrane) involving the deposition of pre-formed crystals as seeds for crystal growth within the porous structure of the membrane becomes unnecessary. It is feasible to form a single crystal of hydrotalcite within the membrane porous structure if the two reactants (i.e., Na2CO3 and AlCl3/MgCl2) can be combined together within the porous

structure. This rationale represents a major breakthrough, which can eliminate many tedious steps in the crystal formation as in the zeolitic membrane development. A two-phase contactor using the membrane as an interphase appears to be an ideal device for us to achieve immediate crystal formation within the porous structure of the membrane. to demonstrate feasibility, a batch type two phase contactor was used to simplify the equipment design, acquisition and set-up.
NTIS
*Membranes; Carbon Dioxide; Ceramics*

**20020066619** Media and Process Technology, Inc., Pittsburgh, PA USA
**CO(2) Selective Ceramic Membrane for Water-Gas Shift Reaction with Concomitant for the Recovery of CO(2)** ***Quarterly Report, 1 Oct. - 31 Dec. 01***
Liu, P. K.; Apr. 09, 2001; 12p; In English
Report No.(s): DE2002-794135; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The first step of this project was to identify the conditions for the formation of hydrotalcite material. A commonly discussed A1/Mg hydrotalcite as chosen for this project study. In addition, the crystal growth kinetics, such as size and rate vs time, are essential background information for us to develop a hydrotalcite membrane synthesis technique. The conditions we chose for the formation of hydrotalcite were well documented in the literature. However, no literature data known to us deals with the crystal size and growth rate. Our objective here is to establish the crystal growth kinetics from a simple empirical study, while leaving the comprehensive study for this project. Crystal formation and its characterization are presented in this section. The crystal growth rate and size are discussed in the next section.
NTIS
*Membranes; Carbon Dioxide; Ceramics*

**20020066659** NASA Marshall Space Flight Center, Huntsville, AL USA
**Materials Properties Research at MSFC**
Presson, Joan B., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 2nd Annual Technology Days, 22-24 May 2002, Huntsville, AL, USA; Sponsored by NASA Marshall Space Flight Center, USA; No Copyright; Avail: Issuing Activity; Abstract Only
MSFC is currently planning, organizing and directing test coupon fabrication and subsequent CTE testing for two mirror materials of specific interest to the AMSD and NGST programs, Beryllium 0-30H (Be 0-30H) and Ultra Low Expansion glass (ULE). The ULE test coupons are being fabricated at MSFC from AMSD core residuals provided by Kodak, The Be 0-30H test coupons are being fabricated at Brush Wellman using residuals from the SBMD. Both sets of test coupons will be sent to a test vendor selected through the NASA competitive proposal process with the test results being provided by written report to MSFC by the end of the fiscal year. The test results will become model input data for the AMSD analysts, both MSFC and contractor, providing an enhancement to the historical CTE data currently available.
Author
*Mirrors; Optical Materials; Beryllium*

**20020066664** NASA Marshall Space Flight Center, Huntsville, AL USA
**SSG SiC Optical Systems in Space**
Robichaud, Joseph, NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 2nd Annual Technology Days, 22-24 May 2002, Huntsville, AL, USA; Sponsored by NASA Marshall Space Flight Center, USA
Contract(s)/Grant(s): NAS8-01085; No Copyright; Avail: Issuing Activity; Abstract Only
Silicon Carbide (SiC) materials provide a number of benefits for space based optical systems. SSG Precision Optronics has extensive experience in the areas of design, fabrication, integration, and test of SiC optical systems. This expertise has been applied to produce a number of SiC-based instruments, including the Miniature Infrared Camera and Spectrometer (MICAS) and Advanced Land Imager (ALI) optical systems which have flown as part of NASA's New Millennium program. Our presentation will provide an overview of SSG's experience in the development of these SiC flight systems.
Author
*Silicon Carbides; Cameras; Infrared Spectrometers; Spacecraft Construction Materials*

## 28
## PROPELLANTS AND FUELS

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

**20020065282** General Accounting Office, Washington, DC USA
**Environmental Contamination: Many Uncertainties Affect the Progress of the Spring Valley Cleanup**
Jun. 2002; 48p; In English
Report No.(s): PB2002-107778; GAO-02-556; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

During World War I, at a portion of American University and in other areas that became the Spring Valley neighborhood in Washington, D.C., the U.S. Army operated a large research facility to develop and test chemical weapons and explosives. After World War I, the majority of the site was returned to private ownership and was developed for residential and other uses. The site now includes, in addition to American University, about 1,200 private residences, Sibley Hospital, 27 embassy properties, and several commercial properties. In 1993, buried ordnance was discovered in Spring Valley, leading to its designation by the Department of Defense (Defense) as a formerly used defense site (FUDS) currently comprising 661 acres. FUDS are properties that were formerly owned, leased, possessed, or operated by Defense or its components, and are now owned by private parties or other governmental entities. These properties, located throughout the USA and its territories, may contain hazardous, toxic, and radioactive wastes in the soil and water or in containers such as underground storage tanks. Other hazards, including unexploded ordnance and unsafe buildings, may also be present on the properties. Such hazards can contribute to deaths and serious illness or pose a threat to the environment. In response to your letter, and as agreed with your offices, this report provides information on the (1) specific roles and responsibilities of the government entities involved at the Spring Valley site, as authorized by statute, regulation, or guidance, and as actually carried out, (2) progress the government entities have made toward identifying and removing hazards at the site, (3) health risks government entities have determined are associated with the hazards at the site and the impact of these risks on cleanup decisions, and (4) estimated cost and schedule of the remaining cleanup. In addition, you asked us to provide a list of sites in the District of Columbia where hazards resulting from federal activities have been found. We have included this list in appendix I. to address these objectives, we reviewed documents on activities conducted at the site during World War I, the progress of cleanup activities at the site, health risks, and estimated costs, and interviewed federal and District of Columbia government officials and other stakeholders. We also reviewed the statutes authorizing various cleanup activities. In addition, we visited the site to observe the activities first-hand and attended meetings of resident and other stakeholder groups formed to advise the cleanup process. We obtained and reviewed records from Defense, the Environmental Protection Agency, and the District of Columbia's Department of Health to develop a list of sites in the District of Columbia where hazards resulting from federal activities have been found.

NTIS
*Soils; Decontamination; Environment Protection; Contamination; Chemicals; Cleaning*

**20020065318** RAND Corp., Santa Monica, CA USA
**Assessing Gas and Oil Resources in the Intermountain West**
Knopman, Debra; Apr. 2002; 13p; In English; Testimony before the Subcommittee on Energy and Mineral Resources of the Committee on Resources of the USA House of Representatives on April 18, 2002
Report No.(s): AD-A403332; RAND/CT-195; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The goal of traditional resource assessments is to estimate the nation's potential supply of natural gas and oil resources. As part of our research, we examined four recent assessments: the U.S. Geological Survey National Oil and Gas Resource Assessment Team, 1995; Minerals Management Service, 2000; National Petroleum Council, 1999; and Potential Gas Committee, 20012. Although the assessments vary, they agree that the Intermountain West contains substantial natural gas and oil resources. These assessments estimate what is called the "technically recoverable" resource3-the amount of the resource that is estimated to be recoverable given certain assumptions about exploration and production capabilities. Resources are evaluated in terms of geological criteria and technical feasibility of recovery, but without economic or other considerations. These estimates, therefore, are not intended to indicate how much resource will likely be developed and at what cost.

DTIC
*Natural Gas; Petroleum Products; Earth Resources*

**20020065412** Harvest Energy Technology, Sun Valley, CA USA
**High Flux Ceramic Membrane for Hydrogen Separation** ***Final Report, 15 Jun. 1998 - 14 Mar. 1999***
May 04, 1999; 50p; In English
Report No.(s): DE2002-770571; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Fuel cells that convert hydrogen to electricity will play an increasingly important role in the generation of future electric power for stationary and transportation sector applications. However, more economic methods to produce hydrogen from fossil fuels are needed. This project addresses the need to develop low cost ceramic membranes for hydrogen separation from reformed fuels. The objective of this project is to develop a perm-selective dense silica membrane on a composite structure with high permeability relative to the current membrane technology. The overall goal of this program is to develop an economic membrane separator that will be demonstrated in a fuel processing system for fuel cell applications.
NTIS
*Ceramics; Hydrogen; Separation; Membrane Structures; Fuel Cells; Electricity*

**20020065441** Department of Energy, Norwich Clean Cities Program - Norwich, CT, USA
**Demonstration of Alternative Fuel, Light and Heavy Duty Vehicles in State and Municipal Fleets** ***Final Report***
Polublatko, P.; Kennedy, J. H.; Tucchio, M. A.; Feb. 06, 2002; 26p; In English
Report No.(s): DE2002-792091; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This project involved the purchase of two Compressed Natural Gas School Buses and two electric Ford Rangers to demonstrate their viability in a municipal setting. Operational and maintenance data were collected for analysis. In addition, an educational component was undertaken with middle school children. The children observed and calculated how electric vehicles could minimize pollutants through comparison to conventionally powered vehicles.
NTIS
*Compressed Gas; Electric Motor Vehicles; Alternatives; Automobile Fuels; Automobiles*

**20020065515** Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
**Density Functional Theory Characterization of the Structure and Gas-Phase, Mid-Infrared Absorption Spectrum of 2-Azido-N,N-Dimethylethanamine (DMAZ)** ***Final Report, Nov. 1999-Jan. 2002***
McQuaid, Michael J.; McNesby, Kevin L.; Rice, Betsy M.; Chabalowski, Cary F.; Jul. 2002; 46p; In English
Contract(s)/Grant(s): Proj-622618H80
Report No.(s): AD-A403693; ARL/APG-TR-2770; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Non-local density functional theory utilizing the B3LYP exchange-correlation functionals with a 6-311++G(d, p) basis set was employed to characterize the geometric parameters and normal modes of 12 equilibrium conformations of 2-azido-N,N-dimethylethanamine. Also known as DMAZ, an experimentally acquired mid-infrared absorption spectrum of this fuel's vapor is analyzed based on the computational results. The analysis indicates that the relative populations of DMAZ conformers in a room-temperature sample do not deviate significantly from expectations based on a Boltzmann distribution calculated from their theoretically determined zero-point corrected energies. The most abundant conformer is found to have the central nitrogen atom of the azido group aligned over the amine lone pair electrons. Since this configuration is likely to inhibit proton transfer to the amine site, it may play an influential role in DMAZ's performance as a hypergol.
DTIC
*Absorption Spectra; Azides (Inorganic); Hypergolic Rocket Propellants*

**20020065562** Desert Research Inst., Reno, NV USA
**C and N Allocation in Pine**
Ball, J. T.; 2002; 50p; In English
Report No.(s): DE2002-762784; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A long standing challenge has been understanding how plants and ecosystems respond to shifts in the balance of resource availabilities. The continuing rise in atmospheric CO2 will induce changes in the availability and use of several terrestrial ecosystem resources. We report on the acquisition and allocation of carbon and nitrogen in Pinus ponderosa Laws. seedlings grown at three levels of atmospheric carbon dioxide (370, 525, and 700 (micro)mol/mol and three levels of soil nitrogen supply in a controlled environment experiment. Nitrogen was applied (0, 100, and 200 (micro)g N g/soil at planting and again at week 26 of a 58-week, 4-harvest experiment. At the final harvest, plants grown with variety low available soil nitrogen showed no significant response to atmospheric CO2. Plants at higher N levels responded positively to CO2 with the highest biomass at the middle CO2 level. Plants growing at the lowest N levels immediately allocated a relatively large portion of their nitrogen and biomass to roots. Plants growing at near present ambient CO2 levels allocated relatively little material to roots when N was

abundant but moved both carbon and nitrogen below-ground when N was withheld. Plants growing at higher CO2 levels, allocated more C and N to roots even when N was abundant, and made only small shifts in allocation patterns when N was no longer supplied. In general, allocation of C and N to roots tended to increase when N supply was restricted and also with increasing atmospheric CO2 level. These allocation responses were consistent with patterns suggesting a functional balance in the acquisition of above-ground versus below-ground resources. In particular, variation in whole tree average nitrogen concentration can explain 68% of the variation ratio of root biomass to shoot biomass across the harvests. The capability to respond to temporal variation in nutrient conditions, the dynamics of nutrient uptake, and the dynamics of nutrient use were all seen to be influenced by the interplay between previous N supply, previous C supply, and the concentration of CO2 in the atmosphere. The data suggest that in an elevated CO2 atmosphere ponderosa pine seedlings will have higher root biomass and be likely to capture more N compared to seedlings today. Further, the combined growth and allocation responses of Ponderosa pine at elevated CO2 resulted in higher growth per unit N (nitrogen productivity) and lower N per gram of tissue (all tissues not just leaves) when nitrogen was not in abundant supply.
NTIS
*Biomass; Carbon; Carbon Dioxide; Nitrogen; Trees (Plants); Controlled Atmospheres*

**20020066404** Argonne National Lab., IL USA
**Direct Capture of Products from Biotransformations**
Mar. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-793090; No Copyright; Avail: National Technical Information Service (NTIS)

This report summarizes the results of a technology assessment for direct capture of products from biotransformations. It focuses on less mature technologies where the bank of knowledge is less mature including separations based on volatility, electrical, or specific interactions. Membrane technology offers some of the most promising breakthroughs if selectivity could be enhanced without reducing flux. Much of the improvements in separations technologies will develop from new materials or new modifications of generic materials including resins, membranes, and solvents. Removal of impurities such as cell debris, proteins, sugars, and salts improves all subsequent separations technologies and should be considered in all processes. Particularly important areas that warrant R&D in biocatalysis are: (1) working with minimal fermentation media to reduce impurities, and (2) enhancing microorganism tolerance to products, acids, and salts to increase titer. Integrating biocatalysis with separations offers the potential for greatly simplifying separations. Two issues appearing repeatedly are pH control of fermentations and continuous removal of products. There is already a large knowledge base covering separations technologies (and materials) for biotransformations. This knowledge base could be better applied if there was an increased R&D focus on the screening, modeling, and data basing requirements in processes and materials. The ultimate key to improved separations is to optimize biocatalysis and separations in an integrated process; simultaneously enhancing both selectivity and flux while reducing impurities and fouling.
NTIS
*Bioconversion; Materials Recovery; Technology Assessment; Chemical Reactions*

**20020066414** Department of Energy, National Petroleum Technology Office, Tulsa, OK USA
**Fossil Energy: Synthesis of Mesoporous Aluminophosphates as Potential Catalyst in the Upgrading Petroleum Feedstocks** ***Annual Report, 1 Sep. 2000 - 31 Aug. 2001***
Ingram, C.; Mar. 2002; 32p; In English
Report No.(s): DE2002-792802; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This project focuses on the synthesis of mesoporous aluminophosphate (AlPO) catalysts for application in the acid catalyzed conversion of large petroleum feedstock compounds to useful middle distillates and naphtha transportation fuels.
NTIS
*Catalysis; Crude Oil*

**20020066421** Alaska Univ., Fairbanks, AK USA
**Oxygen Transport Ceramic Membranes** ***Quarterly Report, Oct. - Dec. 2001***
Bandopadhyay, S.; Nagabhushana, N.; Jan. 2002; 14p; In English
Report No.(s): DE2002-793525; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Conversion of natural gas to liquid fuels and chemicals is a major goal for the Nation as it enters the 21st Century. Technically robust and economically viable processes are needed to capture the value of the vast reserves of natural gas on Alaska's North Slope, and wean the Nation from dependence on foreign petroleum sources. Technologies that are emerging to fulfill this need are all based syngas as an intermediate. Syngas (a mixture of hydrogen and carbon monoxide) is a fundamental building block from which chemicals and fuels can be derived. Lower cost syngas translates directly into more cost-competitive fuels and

chemicals. The currently practiced commercial technology for making syngas is either steam methane reforming (SMR) or a two-step process involving cryogenic oxygen separation followed by natural gas partial oxidation (POX). These high-energy, capital-intensive processes do not always produce syngas at a cost that makes its derivatives competitive with current petroleum-based fuels and chemicals
NTIS
*Natural Gas; Synthesis Gas; Membranes*

**20020066461** Thiokol Corp., Ogden, UT USA
**Saving Lives With Rocket Power**
Spinoff 2000; 2000, pp. 45; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

Thiokol Propulsion uses NASA's surplus rocket fuel to produce a flare that can safely destroy land mines. Through a Memorandum of Agreement between Thiokol and Marshall Space Flight Center, Thiokol uses the scrap Reusable Solid Rocket Motor (RSRM) propellant. The resulting Demining Device was developed by Thiokol with the help of DE Technologies. The Demining Device neutralizes land mines in the field without setting them off. The Demining Device flare is placed next to an uncovered land mine. Using a battery-triggered electric match, the flare is then ignited. Using the excess and now solidified rocket fuel, the flare burns a hole in the mine's case and ignites the explosive contents. Once the explosive material is burned away, the mine is disarmed and no longer dangerous.
Author
*Technology Utilization; Mines (Ordnance); Rocket Propellants; Deactivation*

**20020066477** Department of Energy, Office of Heavy Vehicle Technologies, Washington, DC USA
**Gaseous Fuels in Transportation: Prospects and Promise**
Eberhardt, J. J.; Jul. 2001; In English; This document is color dependent and/or in Landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-771155; No Copyright; Avail: National Technical Information Service (NTIS)

The topics are: the transportation energy situation; transportation options for the 21st century; future of combustion engines in transportation; natural gas as alternative fuel; two-pronged fuels strategy; hydrogen as alternative fuel, and summary.
NTIS
*Fuels; Transportation; Combustion; Gaseous Fuels; Natural Gas; Research and Development*

**20020066541** Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA USA
**Estimated Oil and Gas Reserves, Gulf of Mexico, December 31, 1999**
Crawford, T. G.; Burgess, G. L.; Kinler, C. J.; Prendergast, M. T.; Ross, K. M.; Feb. 2002; In English
Report No.(s): PB2002-107802; OCS/MMS-2002-007; No Copyright; Avail: National Technical Information Service (NTIS)

Remaining proved reserves in the Gulf of Mexico Outer Continental Shelf (OCS) as of December 31, 1999, have been estimated to be 2.98 billion barrels of oil and 23.6 trillion cubic feet of gas. These reserves are recoverable from 815 proved active fields. Unproved reserves as of December 31, 1999, have been estimated to be 2.40 billion barrels of oil and 9.7 trillion cubic feet of gas. These reserves are associated with the 60 unproved active fields studied. There are 5 unproved active fields not studied. In total, there are 880 active fields located in Federal waters. Proved reserves are estimated to have been 14.38 billion barrels of oil and 161.4 trillion cubic feet of gas from 1,003 proved fields in the same geographic area. Included in this number are 188 proved expired depleted fields: not included are the 65 unproved active fields. Estimates were derived for individual reservoirs from geologic mapping and reserve evaluation.
NTIS
*Reserves; Oil Fields; Gulf of Mexico; Natural Gas; Estimating; Crude Oil*

**20020066622** Kansas Univ. Center for Research, Inc., Lawrence, KS USA
**Fossil Energy: Increased Oil Recovery from Mature Oil Fields Using Gelled Polymer Treatments** ***Annual Report, 16 Jun. 2000 - 15 Jun. 2001***
Willhite, G. P.; Green, D. W.; McCool, C. S.; May 2002; 70p; In English
Report No.(s): DE2002-794293; DOE/BC/15209-4; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This program was aimed at reducing barriers to the widespread use of gelled polymer treatments by (1) developing methods to predict gel behavior during placement in matrix rock and fractures, (2) determining the persistence of permeability reduction after gel placement, and (3) developing methods to design production well treatments to control water production.
NTIS
*Oil Fields; Polymers; Oil Recovery*

**20020066627** Department of Energy, Office of Heavy Vehicle Technologies, Washington, DC USA
**Alternative Fuels Program. Natural Gas Engine Research and Development**
2000; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-771164; No Copyright; Avail: National Technical Information Service (NTIS)
Contents include the following: Development of 'Enabling Technologies' in the engine research laboratory for improved energy efficiency and low exhaust emissions; The 'Enhanced Efficiency' Program to aid industry in commercializing higher efficiency natural gas engines.
NTIS
*Internal Combustion Engines; Natural Gas; Research and Development*

**20020066701** National Renewable Energy Lab., Golden, CO USA
**Natural Gas in Transit Fleets: A Review of the Transit Experience**
Eudy, L.; Mar. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-31479; NREL/TP-540-31479; No Copyright; Avail: National Technical Information Service (NTIS)
Use of natural gas in transit bus fleets has grown over the last decade. Often motivated by air quality concerns, the use of natural gas also contributes to national and local energy security. Approximately 9% of the U.S. transit fleet in 2001 was composed of buses operating on some form of natural gas and even more were on order. While some agencies have achieved success with their natural gas programs, others report difficulties and some have suspended their natural gas use altogether. What makes an agency successful in implementing natural gas into their operations. This paper reviews the experience of agencies with natural gas to determine the answer and to provide guidance on how fleets can effectively duplicate the successes and address or avoid the challenges.
NTIS
*Air Quality; Natural Gas; Transportation*

**20020066758** National Renewable Energy Lab., Golden, CO USA
**Assessment of Natural Gas Splitting with a Concentrating Solar Reactor for Hydrogen Production**
Spath, P. L.; Amos, W. A.; Apr. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-31949; NREL/TP-510-31949; No Copyright; Avail: National Technical Information Service (NTIS)
This analysis examined hydrogen production via thermal decomposition of methane using a solar reactor for two different applications: (1) for a fueling station and (2) for power production. For each application three different hydrogen production rates were examined by varying the size of the heliostat field. The fueling station application was examined as a stand-alone system. However, because storage limits the amount of hydrogen production and results in a substantial capital cost, the system was also examined as one that could supply hydrogen to a pipeline network. Based on the quality of the carbon produced at NREL's (National Renewable Energy Lab) High-Flux Solar Furnace, the carbon was assumed to be sold in the carbon black market. For the power production scenario, the hydrogen is co-fired in a turbine at a natural gas combined-cycle plant. If the carbon cannot be sold then it can be used to produce additional power.
NTIS
*Hydrogen Production; Natural Gas; Thermal Decomposition*

**20020066759** Argonne National Lab., IL USA
**DOE/OHVT Natural Gas Vehicle Fueling Infrastructure Program**
Stork, K. C.; Apr. 11, 2000; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-771172; No Copyright; Avail: National Technical Information Service (NTIS)

The report consists of several view graphs on the Natural Gas Fueling Infrastructure Program. It presents an overview of projects sponsored by this government/industry partnership. It also lists the key 'players' in the effort.
NTIS
*Natural Gas; Refueling; Automobile Fuels*

## 29
## SPACE PROCESSING

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

**20020066650** NASA Marshall Space Flight Center, Huntsville, AL USA
**Small Particles in Fluid Concepts and Objectives: Designing and Experiment for Microgravity (SHIVA)**
Witherow, W., NASA Marshall Space Flight Center, USA; Trolinger, J. D., NASA Marshall Space Flight Center, USA; Smith, D. D., NASA Marshall Space Flight Center, USA; Sibille, L., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; Microgravity Materials Science Conference, 25-26 Jun. 2002, Huntsville, AL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

This clearance is for a poster presentation on the Spaceflight Holographic Investigation in a Virtual Apparatus made at the Microgravity Science Materials Conference at the Von Braun Center in Huntsville, Alabama June 25 - 26.
Author
*Microgravity; Holography; Fluid Flow; Particle Theory; Experiment Design*

**20020067448** NASA Marshall Space Flight Center, Huntsville, AL USA
**Toward Understanding Pore Formation and Mobility During Controlled Directional Solidification In A Microgravity Environment Investigation (PFMI)**
Grugel, R. N., NASA Marshall Space Flight Center, USA; Anilkumar, A., NASA Marshall Space Flight Center, USA; Luz, P., NASA Marshall Space Flight Center, USA; Jeter, L., NASA Marshall Space Flight Center, USA; Volz, M. P., NASA Marshall Space Flight Center, USA; Spivey, R., NASA Marshall Space Flight Center, USA; Smith, G. A., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; Microgravity Science Conference, 25 Jun. 2002, Huntsville, AL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The generation and inclusion of detrimental porosity, e.g., "pipes" and "rattails" can occur during controlled directional solidification processing. The origin of these defects is generally attributed to gas evolution and entrapment during solidification of the melt. On Earth, owing to buoyancy, an initiated bubble can rapidly rise through the liquid melt and "pop" at the surface; this is obviously not ensured in a low gravity or microgravity environment. Clearly, porosity generation and inclusion is detrimental to conducting any meaningful solidification-science studies in microgravity. Thus it is essential that model experiments be conducted in microgravity, to understand the details of the generation and mobility of porosity, so that methods can be found to eliminate it. In hindsight, this is particularly relevant given the results of the previous directional solidification experiments conducted in Space. The current International Space Station (ISS) Microgravity Science Glovebox (MSG) investigation addresses the central issue of porosity formation and mobility during controlled directional solidification processing in microgravity. The study will be done using a transparent metal-analogue material, succinonitrile (SCN) and succinonitrile-water "alloys", so that direct observation and recording of pore generation and mobility can be made during the experiments. Succinonitrile is particularly well suited for the proposed investigation because it is transparent, it solidifies in a manner analogous to most metals, it has a convenient melting point, its material properties are well characterized and, it has been successfully used in previous microgravity experiments. The PFMI experiment will be launched on the UF-2, STS-111 flight. Highlighting the porosity development problem in metal alloys during microgravity processing, the poster will describe: (i) the intent of the proposed experiments, (ii) the theoretical rationale behind using SCN as the study material for porosity generation and migration and, (iii) the experimental protocol for the investigation of the effects of the processing parameters. Photographs of the flight experimental hardware, and the novel sample ampoule, will be exhibited. The experimental apparatus will be described in detail and a summary of the scientific objectives will be presented.
Author
*Directional Solidification (Crystals); Porosity; Microgravity; Gas Evolution; Liquid Surfaces; Melting Points*

## 31
## ENGINEERING (GENERAL)

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

**20020066346** National Inst. of Standards and Technology, Metallurgy Div., Gaithersburg, MD USA
**Substrate Analysis Grit Blasting**
Jiggetts, Rodney D., National Inst. of Standards and Technology, USA; Biancaniello, F., National Inst. of Standards and Technology, USA; Ridder, S., National Inst. of Standards and Technology, USA; Mates, S., National Inst. of Standards and Technology, USA; Stoudt, M., National Inst. of Standards and Technology, USA; Schaefer, R., National Inst. of Standards and Technology, USA; Boyer, P., National Inst. of Standards and Technology, USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 455-470; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

This paper presents substrate based analysis grit blasting. The topics include: 1) National Institute of Standards and Technology (NIST)'s Grit Blasting Facility; 2) Grit Impact on Surface; 3) Substrate Surface Analysis Results; and 4) Future Work/Goals. Viewgraphs of grit blasting are also provided.
CASI
*Grit; Substrates; Surface Properties; Mechanical Properties*

**20020066359** Purdue Univ., School of Technology, West Lafayette, IN USA
**Teapot Dribbles and Ladle Pours**
Widener, Edward L., Purdue Univ., USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 637-640; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A01, Hardcopy; A06, Microfiche

Why do bad teapots dribble on your fine linen tablecloth? Some physics books blame surface tension (capillarity) between the hot-tea and china-pot; but simple experiments disprove simplistic explanation. The "wetting" ability of liquid water is enhanced by temperature rise, as surface tension decreases. Also, changing the materials of a liquid-solid interface may greatly change capillarity. But bad teapots still dribble. Misshapen spouts cause spillage, regardless of metal-ceramic-plastic material selection. Applications are obvious: 1) Broad-crested weirs; 2) Dam spillways; 3) Molten-metal ladles; 4) Flow-nets; 5) Fourdrinier wires on Table-rolls.
Author
*Spilling; Water Flow; Liquid-Solid Interfaces; Open Channel Flow*

**20020066410** National Renewable Energy Lab., Golden, CO USA
**Vehicle Transient Air Conditioning Analysis: Model Development and System Optimization Investigations**
Hendricks, T. J.; Jun. 2001; In English; This document is color dependent and/or in landscape layout. It is currently ony available on CD-ROM
Report No.(s): DE2002-30715; NREL/TP-540-30715; No Copyright; Avail: National Technical Information Service (NTIS)

The National Renewable Energy Laboratory (NREL) has developed a transient air conditioning (A/C) system model using SINDA/FLUINT analysis software. It captures all the relevant physics of transient A/C system performance, including two phase flow effects in the evaporator and condenser, system mass effects, air side heat transfer on the condenser/evaporator, vehicle speed effects, temperature-dependent properties, and integration with a simplified cabin thermal model. It has demonstrated robust and powerful system design optimization capabilities. Single-variable and multiple variable design optimizations have been performed and are presented. Various system performance parameters can be optimized, including system COP, cabin cool-down time, and system heat load capacity. This work presents this new transient A/C system analysis and optimization tool and shows some high-level system design conclusions reached to date. The work focuses on R-134a A/C systems, but future efforts will modify the model to investigate the transient performance of alternative refrigerant systems such as carbon dioxide systems. NREL is integrating its transient air conditioning model into NREL's ADVISOR vehicle system analysis software, with the objective of simultaneously optimizing A/C system designs within the overall vehicle design optimization.
NTIS
*Air Conditioning; Applications Programs (Computers)*

**20020066411** National Renewable Energy Lab., Golden, CO USA

**International Energy Agency Building Energy Simulation Test and Diagnostic Method for Heating, Ventilating, and Air-Conditioning Equipment Models (HVAC BESTEST), Volume 1, Cases E100-E200**

Neymark, J.; Judkoff, R.; Jan. 2002; In English; This document is color dependent and/or in landscape layout. It is currently ony available on CD-ROM

Report No.(s): DE2002-30152; NREL/TP-550-30152; No Copyright; Avail: National Technical Information Service (NTIS)

This report describes the Building Energy Simulation Test for Heating, Ventilating, and Air-Conditioning Equipment Models (HVAC BESTEST) project conducted by the Tool Evaluation and Improvement International Energy Agency (IEA) Experts Group. The group was composed of experts from the Solar Heating and Cooling (SHC) Programme, Task 22, Subtask A. The current test cases, E100-E200, represent the beginning of work on mechanical equipment test cases; additional cases that would expand the current test suite have been proposed for future development.

NTIS

*Heating; Ventilation; Air Conditioning*

**20020066459** DynEco Corp., Rockledge, FL USA

**A Blast of Cool Air**

Spinoff 2000; 2000, pp. 78; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

Unable to solve their engineering problem with a rotor in their Orbital Vane product, DynEco Corporation turned to Kennedy Space Center for help. KSC engineers determined that the compressor rotor was causing a large concentration of stress, which led to cracking and instant rotor failure. NASA redesigned the lubrication system, which allowed the company to move forward with its compressor that has no rubbing parts. The Orbital Vane is a refrigerant compressor suitable for mobile air conditioning and refrigeration.

Author

*Technology Utilization; Compressor Rotors; Lubrication Systems; Refrigerants*

**20020066498** UltraStrip Systems, Inc., Stuart, FL USA

**Robotic Stripping**

Spinoff 2000; 2000, pp. 50-51; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

UltraStrip Systems, Inc.'s M-200 removes paint from the hulls of ships faster than traditional grit-blasting methods. And, it does so without producing toxic airborne particles common to traditional methods. The M-2000 magnetically attaches itself to the hull of the ship. Its water jets generate 40,000 pounds of pressure per square inch, blasting away paint down to the ships steel substrate. The only by product is water and dried paint chips and these are captured by a vacuum system so no toxic residue can escape. It was built out of a partnership between the Jet Propulsion Laboratory and the National Robotics Engineering Consortium.

Author

*Technology Utilization; Hydraulic Jets; Paint Removal; Robotics*

**20020066500** Silicon Designs, Inc., Issaquah, WA USA

**Shipping Monitor**

Spinoff 2000; 2000, pp. 42; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

Through a SBIR contract between Kennedy Space Center and Silicon Designs, came the tri-axial data acquisition system, known commercially as the G-Logger. It is a portable, self-contained device that stores and analyzes shock, vibration, and temperature data during payload transport. It is sealed for protection from the weather and can be left unattended for up to three weeks as it collects data. It can easily be linked with any desktop or laptop computer in order to download the collected data. It serves uses in the automotive, shipping, aerospace, and machining industries.

Author

*Data Acquisition; Vibration Measurement; Ground Handling; Payloads; Technology Utilization; Temperature Measurement; Shock Measuring Instruments*

**20020066517** Ball Aerospace and Technologies Corp., USA

**Ball Aerospace Actuator Cryogenic Testing**

Kingsbury, Lana, Ball Aerospace and Technologies Corp., USA; Lightsey, Paul, Ball Aerospace and Technologies Corp., USA;

Quigley, Phil, Ball Aerospace and Technologies Corp., USA; Rutkowski, Joel, Ball Aerospace and Technologies Corp., USA; [2002]; 1p; In English; 2nd Annual Technology Days, 22-24 May 2002, Huntsville, AL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The ambient testing characterizing step size and repeatability for the Ball Aerospace Cryogenic Nano-Positioner actuators for the AMSD (Advanced Mirror System Demonstrator) program has been completed and are presented. Current cryogenic testing is underway. Earlier cryogenic test results for a pre-cursor engineering model are presented.

Author

*Actuators; Cryogenic Equipment*

**20020066620** Consolidation Coal Co., Research and Development Dept., Library, PA USA

**Production of Construction Aggregates from Flue Gas Desulfurization Sludge *Final Report***

Wu, M. M.; McCoy, D. C.; Scandrol, R. O.; Fenger, M. L.; Withum, J. A.; May 2000; 44p; In English

Report No.(s): DE2002-794137; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Through a cooperative agreement with DOE, the Research and Development Department of CONSOL Inc. (CONSOL R&D) teamed with SynAggs, Inc. and Duquesne Light to design, construct, and operate a 500 lb/h continuous pilot plant to produce manufactured aggregates from a mixture of lime wet flue gas desulfurization (FGD) sludge, fly ash, and other components. The pilot plant was designed to provide process scale-up data and information concerning continuous operations based on the bench-scale aggregate production unit. Over the last ten years, CONSOL R&D developed a disk pelletization process to produce manufactured aggregates from coal combustion by-produces at the bench-scale. The aggregates were made using a three-step process that includes mixing, pelletizing, and curing. A variety of useful products, such as lightweight aggregates, American Association of State Highway and Transportation Officials (AASHTO) Class A aggregates, and concrete aggregates, were produced in a semi-continuous bench-scale unit. Typically, 200 to 400 lb of aggregate was produced in a bench-scale run. Small field demonstrations using 1200 lb to 5000 lb of manufactured aggregates made in the semi-continuous bench-scale production were conducted. Aggregates produced from fluidized-bed combustion (FBC) ash and lime wet FGD sludge were used in road construction demonstrations. Aggregates made from spray dryer absorption (SDA) ash and lime wet FGD sludge were used to manufacture concrete masonry units. The aggregate production and development program was successful at bench-scale; however, continuous operation of the process had not been demonstrated. The greatest technological uncertainty was the ability to operate the process in a fully-integrated, continuous manner, and to evaluate scale-up parameters. to evaluate continuous operations and scaleup parameters, the process must be tested and demonstrated at the pilot scale. A proposal to build and operate a continuous aggregate production pilot plant was submitted to DOE in November 1997. The cooperative agreement was awarded by DOE in May 1998.

NTIS

*Desulfurizing; Flue Gases; Sludge*

**20020066687** Department of Energy, Office of Energy Efficiency and Renewable Energy, Washington, DC USA

**International Performance Measurement & Verification Protocol. Concepts and Options for Determining Energy and Water Savings (Revised), Volume 1**

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

Report No.(s): DE2002-31505; DOE/GO-102002-1554; No Copyright; Avail: National Technical Information Service (NTIS)

This protocol serves as a framework to determine energy and water savings resulting from the implementation of an energy efficiency program. It is also intended to help monitor the performance of renewable energy systems and to enhance indoor environmental quality in buildings.

NTIS

*Energy Conservation; Renewable Energy; Water Quality; Performance Tests*

**20020066692** Midwest Research Inst., Kansas City, MO USA

**Barriers to Improved Ventilation in Production Housing. Conference Paper**

Barley, C. D.; Apr. 2002; In English

Report No.(s): DE2002-31665; No Copyright; Avail: National Technical Information Service (NTIS)

In addressing the goals of energy-efficiency and indoor air quality (IAQ) in homes, industry teams in the U.S. Department of Energy's Building America program are installing mechanical ventilation systems in tight homes. This report describes this initiative.

NTIS

*Ventilation; Buildings; Indoor Air Pollution*

**20020067445** NASA Marshall Space Flight Center, Huntsville, AL USA

**NASA's National Center for Advanced Manufacturing**

Vickers, John H., NASA Marshall Space Flight Center, USA; Frazier, Michael K., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 13th AeroMat Conference, 10-13 Jun. 2002, Orlando, FL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

An investment in the future, NASA has designated a new initiative where government, industry, and academia collaborate to meet the manufacturing needs of future space systems. The Marshall Space Flight Center in Huntsville, Alabama has the principal responsibility for implementation of the National Center for Advanced Manufacturing (NCAM). The mission of the NCAM is to build partnerships that will jointly conduct program planning and develop strategies to perform manufacturing research and technology development for critical national missions.

Author

*Aerospace Systems; Manufacturing; NASA Programs; Research and Development*

## 32
## COMMUNICATIONS AND RADAR

*Includes radar; radio, wire, and optical communications; land and global communications; communications theory. For related information see also 04 Aircraft Communications and Navigation; and 17 Space Communications, Spacecraft Communications, Command and Tracking; for search and rescue see 03 Air Transportation and Safety, and 16 Space Transportation and Safety.*

**20020065281** General Accounting Office, Washington, DC USA

**Information Technology: DOD Needs to Improve Process for Ensuring Interoperability of Telecommunications Switches**

Jun. 2002; 104p; In English

Report No.(s): PB2002-107783; GAO-02-681; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

In November 1992, the Department of Defense (DOD) issued a policy requiring systems to be interoperable.1 In May 2000, the department began to enforce this policy for telecommunications (telecom) switches,2 requiring them to be tested and certified for interoperability before being installed for operational use within the DOD network. Persuant to a Congressional request, this GAO report seeks to determine (1) DODs process for certifying and authorizing the interoperability of telecom switches; (2) how the process is being applied, including whether contracting laws and regulations have been violated; and (3) how the process affects vendor competition.

NTIS

*Computer Networks; Interoperability; Switches; Telecommunication*

**20020065298** Naval Postgraduate School, Monterey, CA USA

**Performance Analysis of Adaptive Antenna with Coding and Rake Receiver**

Kiat, Kaiser T.; Mar. 2002; 72p; In English; Original contains color images

Report No.(s): AD-A403533; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

In this thesis, we presented the analytical expressions for probability of bit error (BER), the probability density function (PDF) and cumulative distribution function (CDF) of the output signal-to-noise-plus-interference ratio (SINR) of an adaptive antenna operating in multipath environments with multiple interferers and flat Rayleigh fading. The analytical expressions for BER, PDF and CDF were then developed including the effect of coding and the use of RAKE receiver. The performance of adaptive antenna with and without coding as well as with RAKE receiver was analyzed and compared.

DTIC

*Bit Error Rate; Distribution Functions; Reliability Analysis; Probability Density Functions; Coding*

**20020065302** Physics and Electronics Lab. TNO, The Hague, Netherlands

**Datacommunication with HF Radio *Final Report***

Ponsioen, C., Physics and Electronics Lab. TNO, Netherlands; Overduin, R., Physics and Electronics Lab. TNO, Netherlands; Copeland, P. P., Physics and Electronics Lab. TNO, Netherlands; Niemantsverdriet, J., Physics and Electronics Lab. TNO, Netherlands; May 2002; 86p; In English; Original contains color illustrations

Contract(s)/Grant(s): A99/KL/815; TNO Proj. 015.28648

Report No.(s): TD-01-0281; FEL-01-A100; Copyright; Avail: Issuing Activity

This report describes: 1) The RNLA requirements for data communication with HF radio; 2) The data communication capabilities of the RNLA HF system; 3) The current status of world-wide HF data communication standardisation activities; 4)

Measurements that show HF protocol behaviour of the RNLA HF system under stressed circumstances; and 5) The difficulties in general using TCP/IP over low-bandwidth media. It can be used as a basic support for decisions to be made by the RNLA on future HF radio system enhancements or adaptations.
Author
*Data Transmission; High Frequencies; Protocol (Computers); Radio Communication*

**20020065360** Swedish Defence Research Establishment, Aeronautics Div., Stockholm, Sweden
**Investigation of Time and Frequency Domain Based Methods for Radar Cross Section Calculations**
Fogelklou, O.; Nordstroem, J.; Jun. 2001; 44p; In English
Report No.(s): PB2002-104436; FOI-R-0149-SE; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Most of the radar cross section (RCS) calculations are done in frequency domain. In this report we investigate if the more general time domain solvers can be used with reasonable efficiency for RCS calculations. The wave equation is solved in a 1D domain. At one boundary the in-coming wave is known and at the other, the wave is reflected. We investigate three different cases. In the first case a periodic wave is sent from one boundary and reflected at the other, in the second case a pulse is sent and in the third case, the Helmholtz equation, corresponding to the first case is solved. The orders of accuracy are calculated and the efficiencies are estimated in all the three cases. More efficient algorithms, which take advantage of the precise location of the signal, are also constructed.
NTIS
*Radar Cross Sections; Time Domain Analysis; Computation; Finite Difference Theory*

**20020065464** Naval Postgraduate School, Dept. of Computer Science, Monterey, CA USA
**Free Space Optics and Wireless Broadband Radio Frequency Technology: Bringing High-Speed Network Access to the Last Mile**
Sprague, John W.; Mar. 2002; 83p; In English; Original contains color images
Report No.(s): AD-A403573; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
Existing copper phone and cable infrastructure no longer provide the required broadband for today's emerging applications. Homes and businesses in the "last mile" require the same access to broadband speeds available inside the fiber optic ring. It is not economically feasible, however, to bring fiber optic cable to each and every home and business in the "last mile." Free Space Optics and Wireless Broadband Radio Frequency are two technologies gaining popularity as an alternative broadband infrastructure. Free Space Optics uses lasers and Wireless Broadband uses Radio Frequency waves to send large amounts of data from on place to another. Both are wireless technologies that use free space. As a result, they are quickly deployed, easily scaled, and cheaper to install and upgrade than wired infrastructures. These characteristics support missions of the Armed Forces in which wire-bound infrastructure is not dependable, is impractical to build and maintain, or requires a high degree of mobility. This thesis address the "last mile" problem including why current infrastructure will not provide a broadband solution. free Space Optics and Wireless Broadband Radio Frequency technologies are explored and discussed. Finally, an economic analysis of alternative network designs utilizing the two emerging technologies is applied to a fictitious city with a population of one million.
DTIC
*Optical Communication; Communication Networks; Broadband*

**20020065505** Department of the Air Force, Washington, DC USA
**Air Force Instruction 33-217 Communications and Information Voice Call Sign Program**
Oct. 01, 1997; 6p; In English
Report No.(s): AD-A403713; USAFI-33-217; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
No Abstract
DTIC
*Voice Communication; IFF Systems (Identification)*

**20020066190** Swedish Defence Research Establishment, Aeronautics Div., Stockholm, Sweden
**Discrete Approximations of Electromagnetic Problems**
Persson, J.; Nordstroem, J.; May 2001; 68p; In English
Report No.(s): PB2002-104438; FOI-R-0119-SE; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

In this report second and higher order methods (the Yee-method, Summation By Parts methods and Finite Element Methods) for transportation of electromagnetic waves are compared. Tests of accuracy, long time-integration and efficiency are performed. The authors show that the higher order methods in almost every case outperform the second order methods.
NTIS
*Electromagnetic Radiation; Approximation; Transport Properties*

**20020066192** Swedish Defence Research Establishment, Aeronautics Div., Stockholm, Sweden
**High Order Finite Difference Approximations of Electromagnetic Wave Propagation Close to Material Discontinuites**
Gustafsson, R.; Nordstroem, J.; Apr. 2001; 56p; In English
Report No.(s): PB2002-105009; FOI-R-0120-SE; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
In this paper, electromagnetic wave propagations close to a material discontinuity have been simulated. We have used summation by part (SBP) operators of second, fourth, and sixth order accuracy. The boundary conditions have been imposed by the simultaneous approximation term (SAT) procedure. Stability has been shown and the orders of accuracy have been verified numerically.
NTIS
*Wave Propagation; Electromagnetic Radiation; Finite Difference Theory; Electromagnetic Wave Transmission*

**20020066197** National Telecommunications and Information Administration, Washington, DC USA
**Measurements of Pulsed Co-Channel Interference in a 4-GHz Digital Earth Station Receiver**
Sanders, F. H.; May 2002; 34p; In English
Report No.(s): PB2002-106749; NTIA-02-393; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Pulsed signals in Earth station receiver spectrum bands have traditionally occurred due to unwanted emissions from adjacent-band transmitters such as radars and altimeters. Analog Earth station sometimes experience interference from such emissions. The trend towards increasing use of digital receivers, coupled with a possible future increases in pulsed signals, have raised the question of the circumstances under which pulsed emissions may cause interference to such receivers. This report documents the results of measurements in which a variety of co-channel pulsed signals were injected into the radio frequency (RF) front-end of an operational, television receive-only (TVRO) digital Earth station. The results identified the susceptibility of the Earth station to pulsed interference as a function of pulse characteristics that included pulse width, pulse repetition rate (both constant and jittered), and peak amplitude. The results indicate that digital Earth station receivers may be vulnerable to interference that creates either a contiguous block of symbol errors or a long series of symbol errors. Interference with lower pulse repetition rates, pulse widths, and duty cycles may also produce effects; in those cases results show the interference amplitude may be increased by as much as 60 dB above the carrier level before significant interference occurs. Quantitative interference thresholds are provided for the performance of electromagnetic compatibility analyses between pulsed interference sources and digital Earth station receivers. Examples of such analyses are provided.
NTIS
*Electromagnetic Compatibility; Pulse Repetition Rate; Radio Communication*

**20020066198** National Telecommunications and Information Administration, Washington, DC USA
**Wireless Link Statistical Bit Error Model**
Lemmon, J. J.; Jun. 2002; 44p; In English
Report No.(s): PB2002-106748; NTIA-02-394; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
A bit error model that enables simulations of the digital error performance of wireless communication links has been developed. The model development has been based on error sequences derived from waveform simulations of wireless link performance with various modems operating under varying propagation, noise, and interference conditions. Values of the model parameters are obtained by analyzing the distributions of the lengths of error bursts and error gaps (error-free intervals). Mathematical expressions have been derived for the means and variances of the error burst and error gap distributions of the model as functions of the model parameters. Constraining the means and variances to the values obtained from waveform simulations uniquely determines values of the model parameters corresponding to a given set of link conditions. Examples of error burst and error gap distributions obtained from waveform simulations are compared with those generated by the model for a land mobile radio system and a wireless local area network. The simulated and model distributions are quite similar; however, the model runs tens of thousands of times faster than the corresponding waveform simulations, enabling rapid determination of link performance.
NTIS
*Bit Error Rate; Telecommunication; Waveforms; Wireless Communication*

**20020066315** State Univ. of Southeast Missouri, Dept. of Physics, Cape Girardeau, MO USA

**The Distribution of Electromagnetic Energy in a Microwave Oven**

Dahiya, Jai N., State Univ. of Southeast Missouri, USA; Decker, Wendy, State Univ. of Southeast Missouri, USA; Anand, Aman, State Univ. of Southeast Missouri, USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 41-62; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

The main Objective of this experiment is to study the distribution of temperature in a food sample placed inside the microwave oven. Electromagnetic Distribution of the microwave field is studied by placing the food sample inside a microwave oven. This distribution is studied in terms of change of temperature as the microwaves are absorbed by a particular food sample. A series of thermometers are probed in a circular fashion in the food sample. The penetration depth of these thermometers are kept constant. The microwave oven is turned on for a certain time and the thermometers are read as quickly as possible as discussed in the procedure section of this paper. The distribution of temperature is related to the microwave field pattern inside the microwave oven.

Derived from text

*Microwaves; Heating Equipment; Electromagnetic Radiation; Temperature Distribution*

**20020066397** Irvine Sensors Corp., Redhawk Vision, Inc., Costa Mesa, CA USA

**Picturing Video**

Spinoff 2000; 2000, pp. 48; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

Video Pics is a software program that generates high-quality photos from video. The software was developed under an SBIR contract with Marshall Space Flight Center by Redhawk Vision, Inc.--a subsidiary of Irvine Sensors Corporation. Video Pics takes information content from multiple frames of video and enhances the resolution of a selected frame. The resulting image has enhanced sharpness and clarity like that of a 35 mm photo. The images are generated as digital files and are compatible with image editing software.

Author

*Technology Utilization; Video Tapes; Digital Data; Photographs*

**20020066433** Oak Grove Systems, Inc., Altadena, CA USA

**Web Time-Management Tool**

Spinoff 2000; 2000, pp. 56-57; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

Oak Grove Reactor, developed by Oak Grove Systems, is a new software program that allows users to integrate workflow processes. It can be used with portable communication devices. The software can join e-mail, calendar/scheduling and legacy applications into one interactive system via the web. Priority tasks and due dates are organized and highlighted to keep the user up to date with developments. Reactor works with existing software and few new skills are needed to use it. Using a web browser, a user can can work on something while other users can work on the same procedure or view its status while it is being worked on at another site. The software was developed by the Jet Propulsion Lab and originally put to use at Johnson Space Center.

Author

*Technology Utilization; World Wide Web; Communication Equipment; Scheduling; Tasks*

**20020066450** Naval Academy, Annapolis, MD USA

**Development of a Digital Signal Processor (DSP) Based Chaotic Communication System With Emphasis on Military Applications**

Reddell, Noah F.; May 07, 2002; 111p; In English; Original contains color images

Report No.(s): AD-A403362; No Copyright; Avail: CASI; A06, Hardcopy

Chaotic systems are aperiodic, deterministic, and sensitive to slight variations in initial condition. The latter property presents the problem that behavior of the system cannot be predicted for a significant period of time, even though for the next instant, it is completely predictable. The frequency domain and time domain properties of chaotic systems have generated interest in the military communications field. This paper explores the advantages of a communication system based on a chaotic carrier for military purposes. Digital signal processing techniques are used to implement the system, perform frequency domain analysis, and generate system performance curves. A series of computer simulations were used to enhance system performance. A digital transmitter was developed that is difficult to localize and detect by exploiting some of the natural properties of chaotic systems. A new dual synchronizing receiver scheme is demonstrated that works by storing samples over an entire bit period prior to

estimation. Results show significantly better bit error probability performance in comparison to previously published methods. Research concentrated on developing a system that works effectively without a conspicuous signature in the frequency domain. Such a system should be extremely useful for cover wireless communications.
DTIC
*Signal Processing; Military Technology; Error Analysis*

**20020066466** Omni Technologies, Inc., New Orleans, LA USA
**Data GOES the Distance**
Spinoff 2000; 2000, pp. 84; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

Omni Technologies, Inc. worked with Stennis Space Center to develop the FOTR-125, a redundant fiber-optic transceiver for remote transmission of high-speed digital data. The 125-megabit-per-second transceiver can collect data for up to 25 kilometers, much longer than standard coaxial cable, which is limited to 50 meters. The Research Triangle Institute assisted in determining the commercial marketplace for the technology.
Author
*Technology Utilization; Digital Data; Fiber Optics; Transmitter Receivers; Data Transmission*

**20020066492** SICOM, Inc., Scottsdale, AZ USA
**Increasing the Flow**
Spinoff 2000; 2000, pp. 64; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

Under an SBIR contract with Glenn, SiCOM, Inc. has developed circuit cards for improved wireless communications. The high-speed wireless digital modem is useful for satellite to earth communication links. Commerical applications include HDTV broadcasts, digital satellite news gathering, Ethernet links and Local Multipoint Distribution Service (LMDS). The cards are programmable and allow customers to choose modulation frequencies to best serve their needs.
Author
*Technology Utilization; Data Links; Modems; Broadcasting; Circuit Boards; Wireless Communication*

**20020066533** Federal Communications Commission, Washington, DC USA
**Alternative Frequencies for Use by Public Safety Systems**
2002; 36p; In English
Report No.(s): PB2002-107869; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report is divided into three sections. The first section provides a framework for an analysis of non-Federal Government spectrum responsive to the reporting requirement by examining the legislative history of Section 1705(c) of the NDAA-01. The second section discusses how to define alternative frequencies in the context of Section 1705(c) and identifies specific non-Federal Government spectrum that falls within the scope of such definition. The third section provides the results of an analysis of whether such alternative frequencies are available for use by public safety systems within the meaning of Section 1705(c).
NTIS
*Telecommunication; Aerospace Safety; Systems Engineering*

**20020066552** Transtek, Inc., Pittsburgh, PA USA
**Industrial Prototype Modules for Wireless Through-the-Earth Communication** ***Quarterly Report, 1 Jan. - 31 Mar. 2002***
Meiksin, Z. H.; Apr. 2002; 12p; In English
Report No.(s): DE2002-793665; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Two industrial prototype units for through-the-earth wireless communication were constructed and tested. Preparation for a temporary installation in NIOSH's Lake Lynn mine for the through the- earth and the in-mine system were completed. Progress was made in the programming of the in-mine system to provide data communication. Work has begun to implement a wireless interface between equipment controllers and our in-mine system.
NTIS
*Communication Equipment; Wireless Communication; Data Transmission; Prototypes*

**20020066583** National Telecommunications and Information Administration, Washington, DC USA
**Current and Future Spectrum Use by the Energy, Water, and Railroad Industries**
Mao, J. F.; Ross, M. W.; Jan. 2002; 98p; In English
Report No.(s): PB2002-108112; NTIA-SP-01-49; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche
Public Law 106-553, The Departments of Commerce, Justice, and State, the Judiciary, and Related Agencies Appropriations Act of 2001, requires the NTIA Administrator, after consultation with federal agencies and departments responsible for regulating the core operations of entities engaged in the provision of energy, water, and railroad services, to submit to Congress a study of current and future use of spectrum by these entities to protect and maintain the nation's critical infrastructure. to compile the information necessary to complete the report, NTIA solicited private sector entities engaged in energy, water, and railroad services for their current and future spectrum needs. This was conducted through a 'Request for Comments' (RFC) procedure, which was published in the Federal Register. to comply with the language contained in PL 06-553, a letter of inquiry was also sent to those regulatory federal agencies that have oversight of these industries.
NTIS
*Industries; Electromagnetic Spectra*

**20020066788** Defence Science and Technology Organisation, Communications Div., Edinburgh Australia
**Demand Moderation in Military Communication Networks**
Blackmore, Perry A., Defence Science and Technology Organisation, Australia; April 2002; 32p; In English
Report No.(s): DSTO-TR-1286; DODA-AR-012-176; Copyright; Avail: Issuing Activity
Interconnected heterogeneous networks with diverse ownership, carrying a wide range of multimedia traffic with extreme variations in load will characterize military networks of the future. Consequently, the design of a management and control architecture, which fosters efficient and military-tailored resource sharing, is a challenging multifaceted problem. A key feature of such an architecture is to give the network the ability to deliver meaningful signals to users in order for them to modify their behavior in a way that is beneficial to the network as a whole. For example, during times of network stress, users should be discouraged from excessive network usage. Demand moderation is the term used to encompass the array of mechanisms aimed at achieving this end. Integrated Defense networks of the future should benefit enormously from demand moderation mechanisms.
Author
*Communication Networks; Armed Forces; Network Control; Technological Forecasting; Computer Networks*

## 33
## ELECTRONICS AND ELECTRICAL ENGINEERING

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

**20020065272** Aerospace Corp., Lab. Operations, El Segundo, CA USA
**Radiation Effects on a Small DC-DC Converter and a Remedy by Circuit Design Technique**
Truong, C. H.; Simburger, E. J.; Lacoe, R. C.; Ross, J. C.; Brown, S.; May 01, 2002; 11p; In English
Contract(s)/Grant(s): F04701-00-C-0009
Report No.(s): AD-A403299; TR-2002(8555)-2; SMC-TR-02-27; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This report presents the complete results of the total-dose and dose-rate testing on a typical-high-efficiency, low-power, low-voltage DC-DC converter used in commercial portable devices. The purpose of these investigations was to characterize performance of the converter in radiation environment at high and low dose rates. Results of the test include time-domain performance and frequency response before and after the irradiation. The converter maintained regulation control at 100 krads; however, the output voltage regulation drifted-up. Adding an external standby output-voltage regulating circuit has successfully solved the problem.
DTIC
*Voltage Converters (DC to DC); Radiation Effects; Voltage Regulators; Irradiation*

**20020065284** Utah Univ., Office of Sponsored Projects, Salt Lake City, UT USA
**AASERT-ISNP. Micro-Electro-Mechanical Systems (MEMS) Research for Intelligent Sensor Network and Smart Structures *Final Report***
Jun. 28, 2002; 3p; In English

Contract(s)/Grant(s): N00014-97-1-0669
Report No.(s): AD-A403588; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Under the AASERT-ISAS project, the Center for Engineering Design sought to refine processing techniques associated with cylindrical microfabrication and use these processes to assemble a functional microelectrode fabricated on a cylindrical substrate. Processes such as small feature patterning, passivation layer application, and connection methods were investigated.

DTIC

*Substrates; Microelectromechanical Systems*

**20020065334** Virginia Univ., School of Engineering and Applied Science, Charlottesville, VA USA

**Exponentially Unstable Plants With Saturating Actuators** ***Final Report, 1 May 1999-30 Apr. 2002***

Lin, Zongli; Jun. 26, 2002; 499p; In English

Contract(s)/Grant(s): N00014-99-1-0670

Report No.(s): AD-A403409; GG10082; No Copyright; Avail: CASI; A21, Hardcopy; A04, Microfiche

Every physical actuator is subject to saturation. For this reason, the original formulations of many fundamental control problems, including controllability and time optimal control, all reflect the constraints imposed by actuator saturation. Control problems that involve hard nonlinearities such as actuator saturation, however, turned out to be difficult to deal with. As a result, even though there have been continual efforts in addressing actuator saturation for a chronological bibliography on this subject, it's effect had been ignored in most of the modern control literature. This report summarizes the results obtained under this project. For clarity we have itemized each result as appeared in the book or journal publications.

DTIC

*Actuators; Saturation (Chemistry); Fuzzy Systems; Nonlinear Systems*

**20020065346** Florida International Univ., Miami, FL USA

**Controlling Electron Transfer Through Single Molecules** ***Final Report, 1 Mar. 1999-30 Nov. 2001***

Tao, Nongjian; Nov. 2001; 11p; In English

Contract(s)/Grant(s): F49620-99-1-0112

Report No.(s): AD-A403548; AFRL-SR-AR-TR-02-0211; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We have accomplished both tasks stated above and are ready for the next step-building a prototype molecular device based on single molecules. For the first task, we have developed a novel electrochemical technique to fabricate nanoelectrodes separated with an appropriate gap for molecular connection. It starts with a thin metal wire coated with an insulation layer except for a small portion near the center (Fig. 1a), and then etches the center portion electrochemically while monitoring the current through the wire (Fig. lb). As the diameter of the center portion decreases to the electron wavelength (a few A), the conductance becomes quantized and an atomically thin wire is formed. Further etching away the last few atoms produces a pair of nanoelectrodes separated with a small gap, and the ballistic transport responsible for the conductance quantization is replaced by quantum tunneling across the gap (Fig. 1c). As we shall show below, the tunneling current is also quantized because of the discrete nature of atoms, which can be used to control the gap width with atomic precision. Once a pair of nanoelectrodes with an appropriate gap is formed, we then bridge the gap with molecules by electrochemical deposition (Fig. 1d). In order to quickly fabricate a large array of the nanoelectrodes, we are currently testing a self-terminated method in collaboration with Motorola. We carried out the second task using conducting polymers as a model system. Conducting polymers are attractive electronic materials for a number of reasons.

DTIC

*Molecules; Semiconductor Devices; Electron Transfer; Conducting Polymers*

**20020065413** Oak Ridge National Lab., TN USA

**Soft Commutated Direct Current Motor**

Hsu, J. S.; 1999; 14p; In English

Report No.(s): DE2002-771128; ORNL/CP-97774; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A novel soft commutated direct current (DC) motor is introduced. The current of the commutated coil is intentionally drained before the brush disconnects the coi1. This prevents the spark generation that normally occurs in conventional DC motors. A similar principle can be applied for DC generators.

NTIS

*Direct Current; Electric Motors; Commutators; Electric Coils*

**20020065448** Defence Science and Technology Organisation, Weapons Systems Div., Fishermans Bend, Australia
**Non-linear and Robust Filtering: From the Kalman Filter to the Particle Filter**
Ford, Jason J., Defence Science and Technology Organisation, Australia; April 2002; 39p; In English
Report No.(s): DSTO-TR-1301; DODA-AR-012-300; Copyright; Avail: Issuing Activity

This report presents a review of recent non-linear and robust filtering results for stochastic systems. We focus on stability and robustness issues that arise in the filtering of real systems. Issues such as numeric stability and the effect of non-linearity are also considered. The report begins by introducing the famous Kalman filtering problem before proceeding to introduce the extended Kalman filter and related stability results. Robust forms of the Kalman filter and extended Kalman filter are also considered and finally a particle filtering approach is presented. The report is intended to lead readers with a familiarity of the Kalman filtering problem through some of the more important recent (and not so recent) results on stability and robust filters in nonlinear filtering problems.

Author

*Nonlinear Filters; Robustness (Mathematics); Stochastic Processes*

**20020065466** Boston Univ., Dept. of Electrical and Computer Engineering, Boston, MA USA
**III-Nitride UV Detector Arrays Fabricated by Combining HVPE Lateral Epitaxial Overgrowth and MBE Methods** ***Final Report, 1 Jan. 1999-31 Dec. 2001***
Moustakas, Theodore D.; May 15, 2002; 36p; In English; Original contains color images
Contract(s)/Grant(s): N00014-99-1-0309
Report No.(s): AD-A403567; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The work focused on the fabrication of GaN and AlGaN detectors. Material studies of AlGaN alloys have been undertaken to improve the absorption characteristics and to develop films free of cracks. The devices were fabricated in the form of Schottky barriers, p-n and p-i-n junctions. to reduce the dark current in these devices, a number of approaches were investigated (use of thick GaN templates grown by the HVPE and the LEO methods, or utilized a number AlN interlayers prior to the growth of the device structure). A lithographic mask set was developed for the deposition of detector arrays with various configurations. High quantum efficiency (70%) Schottky barriers with five orders of magnitude visible light rejection were fabricated. P-n and p-i-n detectors with dark current at low reverse bias of about 10(exp -11) Amps/sq cm were fabricated. Rapid thermal annealing in forming gas was found to reduce the junction leakage current by orders of magnitude. These devices were found to have gains higher than one, a result attributed to photoconductive gain in the dislocation regions.

DTIC

*Molecular Beam Epitaxy; Ultraviolet Detectors; Quantum Efficiency; Epitaxy*

**20020065506** Illinois Univ., Electrical Engineering Research Lab., Urbana, IL USA
**Research on Semiconductors** ***Progress Report, 15 Jun.-15 Sep. 1963***
Sep. 24, 1963; 4p; In English
Contract(s)/Grant(s): AF49(638)-417
Report No.(s): AD-A403715; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

No Abstract

DTIC

*Semiconductors (Materials); Electron Tunneling*

**20020065507** Illinois Univ., Electrical Engineering Research Lab., Urbana, IL USA
**Research on Semiconductors** ***Progress Report, 15 Mar.-15 Jun. 1963***
Jun. 15, 1963; 5p; In English
Contract(s)/Grant(s): AF49(638)-417
Report No.(s): AD-A403716; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

No Abstract

DTIC

*Semiconductors (Materials); Optical Properties*

**20020065537** NASA Ames Research Center, Moffett Field, CA USA

**Why is it Doing That? - Assumptions about the FMS**

Feary, Michael, NASA Ames Research Center, USA; Immanuel, Barshi, NASA Ames Research Center, USA; [1998]; 1p; In English; 10th International Symposium on Aviation Psychology, 2-6 May 1999, Columbus, OH, USA

Contract(s)/Grant(s): NCC2-798; No Copyright; Avail: Issuing Activity; Abstract Only

In the glass cockpit, it's not uncommon to hear exclamations such as "why is it doing that?". Sometimes pilots ask "what were they thinking when they set it this way?" or "why doesn't it tell me what it's going to do next?". Pilots may hold a conceptual model of the automation that is the result of fleet lore, which may or may not be consistent with what the engineers had in mind. But what did the engineers have in mind? In this study, we present some of the underlying assumptions surrounding the glass cockpit. Engineers and designers make assumptions about the nature of the flight task; at the other end, instructor and line pilots make assumptions about how the automation works and how it was intended to be used. These underlying assumptions are seldom recognized or acknowledged, This study is an attempt to explicitly arti culate such assumptions to better inform design and training developments. This work is part of a larger project to support training strategies for automation.

Author

*Cockpits; Education; Tasks; Flight Crews*

**20020066344** Loyola Coll., Dept. of Electrical Engineering and Engineering Science, Baltimore, MD USA

**Motorless Motion with NiTi: A Senior Design Project**

Keilson, Suzanne, Loyola Coll., USA; Redfield, Robert, Loyola Coll., USA; Guarraia, Michael, Loyola Coll., USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 441-450; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

The senior design capstone course at Loyola College is intended to be a culmination of undergraduate coursework. All students in both the electrical engineering and engineering science programs take the same course and learn project management and professional skills together. The design project should consider realistic engineering constraints such as cost, time, manufacturability (such as the ability to solder parts together), and power consumption. From the students' perspective, some of the project goals include gaining a more thorough understanding of a material and its properties (based on theoretical knowledge and current manufacturing practice), to design a socially beneficial project, and to construct a working model under the aforementioned constraints. The goal of this project was to develop a senior design project around the principle of motorless motion utilizing the shape memory properties of a Nickel-Titanium (NiTi) alloy. Ultimately, this was incorporated into a working prototype of a three-fingered robotic hand.

Derived from text

*Electrical Engineering; Nickel Alloys; Titanium Alloys; Robotics; Biodynamics*

**20020066353** Norfolk State Univ., Dept. of Technology, VA USA

**Smart Material Actuators**

Woodall, Charlie E., Norfolk State Univ., USA; Yi, Won J., Institute for Computer Applications in Science and Engineering, USA; Golembiewski, Walter, Norfolk State Univ., USA; Song, Kyo D., Norfolk State Univ., USA; National Educators' Workshop: Update 2001: Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 579-585; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

An experimental study of a smart materials actuator driven by microwaves is presented in this paper. A proof of concept experiment using THUNDER (Thin Layer Composite Unimorph Ferroelectric Driver and Sensor) Materials has been set up and demonstrated using microwaves. The smart material actuator system driven by microwaves may have applications, such as the Next Generation Space Telescope (NGST) with fragmented optics control.

Derived from text

*Actuators; Ferroelectric Materials; Smart Materials; Piezoelectricity; Microwaves*

**20020066773** Defence Science and Technology Organisation, Weapons Systems Div., Fishermans Bend, Australia

**The Performance of Small Support Spatial and Temporal Filters for Dim Point Target Detection in IR Image Sequences**

Warren, R. C., Defence Science and Technology Organisation, Australia; February 2002; 40p; In English

Report No.(s): DSTO-TR-1282; DODA-AR-012-165; Copyright; Avail: Issuing Activity

The effectiveness of small support spatial filters based on mean, median and morphological opening for the detection of scintillating ultra-dim stationary point targets in IR (infrared) image sequences has been investigated. The effectiveness of two temporal filters was also studied. The filters were applied to two IR image sequences; an aircraft approaching in an uncluttered background, and an aircraft receding in a bright cloudy background. The spatial filters were effective in detecting the target in

the benign background, but neither the spatial nor one of the temporal filters were effective in the cluttered environment. A combination of absolute frame differencing and small support spatial filtering to correct for sensor motion was found to give sufficient increase in signal to clutter ratio to allow detection.
Author
*Infrared Imagery; Spatial Filtering; Image Filters; Target Recognition; Military Technology*

## 34
## FLUID MECHANICS AND THERMODYNAMICS

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

**20020065266** Naval Surface Warfare Center, Population and Fluidssystems Dept., Bethesda, MD USA
**Numerical Simulation of Flow in Linear Cascade With Tip Clearance**
Yang, Cheng-I; Sep. 2000; 30p; In English; Original contains color images
Report No.(s): AD-A403316; NSWCCD-50-TR-2000/053; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The evolution of the tip separation vortex, the tip leakage vortex and the passage vortex generated by flow over a low-speed linear compressor cascade with tip clearance was studied by solving the Navier-Stokes equations numerically. The discretization is based on flux-difference splitting, implicit high-resolution scheme. Up to a third-order accurate upwind differencing is achieved through a reconstruction of the solution from it's cell averages. Balwin-Lomax turbulence model with blending function to account for the comer flow was used for the turbulence closure. The formation and the development of the vortices were simulated and were compared with experimental observation.
DTIC
*Navier-Stokes Equation; Turbulence Models; Boundary Layer Separation*

**20020065331** Michigan Univ., Ann Arbor, MI USA
**Hydrofoil Static Pressure Acquisition at High Reynolds Number**
Hamel, Joshua M.; Dec. 2001; 111p; In English
Contract(s)/Grant(s): N62271-97-G-0062
Report No.(s): AD-A403412; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
From 1999 through 2001 the University of Michigan carried out an experimental study of the high Reynolds number turbulent flow over a hydrofoil. The high Reynolds number foil, or Hifoil project was carried out in three phases at the U.S. Navy's William B. Morgan Large Cavitation Channel (LCC), the world's largest variable pressure recirculating water tunnel. Several standard flow measurements were made over the course of this project, including surface static pressure field measurements. Static pressure was measured through the use of surface static pressure taps drilled into the foil model at various chordwise and spanwise locations. Pressure data was collected by a custom designed and built static pressure acquisition system, which could automate the process if so desired. The foil model was a modified NACA 16 shape with a chord of 7 feet and a span of 10 ft. The baseline foil was tested at 0, - 1 and + 1 degrees angle of attack measure relative to the foil's flat pressure side. Additional data was collected on the foil with a modified trailing edge shape again at 0 degrees angle of attack. Data was collected at flow speeds ranging from 1.5 to 18.3 m/s and at temperatures ranging from 22 to 40 deg C (70 to 104 deg F), resulting in a chord based Reynolds number range of 3 to 60 million. The Reynolds number range extends from the existing model scale up to full scale for some naval applications. Data is presented here in the form of normalized nondimensional pressure as a function of chordwise location represented in percentage of chord at all the various geometric and flow speed test conditions. In addition a numeric integration of the pressure curves was performed to calculate the pressure lift generated by the foil at the various test conditions. This data is also presented in the form of lift coefficient as a function of foil configuration and Reynolds number.
DTIC
*High Reynolds Number; Hydrofoils; Static Pressure; Scale Models*

**20020065375** New Mexico Univ., Dept. of Mathematics and Statistics, Albuquerque, NM USA
**Shear Layer Stability in a Two Dimensional Disk**
Wolverton, Robert H.; Dec. 2001; 124p; In English
Report No.(s): AD-A403267; CI02-147; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
The dynamics of rotating fluids provide a rich aggregate of periodic, quasi-periodic, and irregular behavior. Many investigations of two-dimensional (2D) flows containing fluid velocity inflections present the Kelvin-Helmholtz (KH) instability.

In this investigation we study the saturation of the KH instability for a forced circular shear layer in a differentially rotating split-disk. Complex vortex interactions are reasonably well understood through experimentation but modeling them requires highly accurate numerical schemes. To explore these flows our investigations employ an efficiently parallelized, highly accurate pseudospectral scheme for the solution of the incompressible Navier-Stokes equations in a disk geometry, Torres & Coutsias. Beyond the initial KH instability, secondary transitions in the flow yield symmetry breaking bifurcations resulting in periodic and irregular states. Simulations are provided for the intermediate states between the n = 4 and n = 3 vortex braids. Oscillating states not previously seen in numerical studies are reported. Unlike the jump transitions between braids of different order, the oscillating states were found to be supercritical bifurcations and thus, not hysteretic. Period doubling bifurcations are observed during some spin-up studies in which intermediate symmetry breaking bifurcations are bypassed. Accurate spectral simulation offers the means for systematic exploration of the dynamics associated with rotating fluids. Herein we construct such a scheme and present bifurcation analysis for secondary transitions.
DTIC
*Two Dimensional Flow; Incompressible Flow; Kelvin-Helmholtz Instability; Shear Layers*

**20020065455** Lawrence Livermore National Lab., Livermore, CA USA
**Estimating the Maximum Splat Diameter of a Solidifying Droplet**
Hadjiconstantinou, N. G.; Mar. 31, 1999; 12p; In English
Report No.(s): DE2002-792296; UCRL-133712; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
We present a simple analytical model for the estimation of the maximum splat diameter of an impacting droplet on a subcooled target. This work is an extension of the isothermal model of Pasandideh-Fard et al. (1996). The model uses an energy conservation argument, applied between the initial and final drop configurations, to approximately capture the dynamics of spreading. The effects of viscous dissipation, surface tension, and contact angle are taken into account. Tests against limited experimental data at high Reynolds and Weber numbers indicate that an accuracy of the order of 5% is achieved with no adjustable parameters required. Agreement with experimental data in the limit We (yields) (infinity) is also very good. We additionally propose a simple model for the estimation of the thickness of the freezing layer developed at the droplet-substrate contact during droplet spreading. This model accounts for the effect of thermal contact resistance and its predictions compare favorably with experimental data.
NTIS
*Heat Transfer; Drops (Liquids); Mathematical Models; Thermal Resistance; Contact Resistance*

**20020066251** Air Products and Chemicals, Inc., Allentown, PA USA
**Engineering Development of Slurry Bubble Column Reactor (SBCR) Technology. Quarterly Technical Progress Report No. 16** ***Final Report, 1 Jan. - 31 Mar. 1999***
Toseland, B. A.; Kornosky, R. M.; Mar. 1999; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-794001; No Copyright; Avail: National Technical Information Service (NTIS)
The major technical objectives of this program are threefold: (1) to develop the design tools and a fundamental understanding of the fluid dynamics of a slurry bubble column reactor to maximize reactor productivity, (2) to develop the mathematical reactor design models and gain an understanding of the hydrodynamic fundamentals under industrially relevant process conditions, and (3) to develop an understanding of the hydrodynamics and their interaction with the chemistries occurring in the bubble column reactor. Successful completion of these objectives will permit more efficient usage of the reactor column and tighter design criteria, increase overall reactor efficiency, and ensure a design that leads to stable reactor behavior when scaling up to large diameter reactors.
NTIS
*Product Development; Reactor Design; Reactor Technology; Slurries; Bubble Technique; Columns (Process Engineering)*

**20020066252** Air Products and Chemicals, Inc., Allentown, PA USA
**Engineering Development of Slurry Bubble Column Reactor (SBCR) Technology. Quarterly Technical Progress Report No. 17** ***Final Report, 3 Apr. 1995 - 30 Jun. 1999***
Toseland, B. A.; Kornosky, R. M.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-794000; No Copyright; Avail: National Technical Information Service (NTIS)
The major technical objectives of this program are threefold: (1) to develop the design tools and a fundamental understanding of the fluid dynamics of a slurry bubble column reactor to maximize reactor productivity, (2) to develop the mathematical reactor design models and gain an understanding of the hydrodynamic fundamentals under industrially relevant process conditions, and

(3) to develop an understanding of the hydrodynamics and their interaction with the chemistries occurring in the bubble column reactor. Successful completion of these objectives will permit more efficient usage of the reactor column and tighter design criteria, increase overall reactor efficiency, and ensure a design that leads to stable reactor behavior when scaling up to large diameter reactors.
NTIS
*Bubble Technique; Reactor Technology; Slurries; Reactor Design; Product Development*

**20020066319** Naval Academy, Dept. of Mechanical Engineering, USA
**Windmill-Powered, Propeller-Driven Boat Design-Build Engineering Project**
Carr, Matthew A., Naval Academy, USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 87-94; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

This engineering project answers the question: "Can a boat use wind power to propel itself directly into the wind?" The solution is a model boat with a windmill mounted on it that is connected to a propeller that, in turn, propels the boat. This project is designed as a team competition and is suitable for students ranging from high school physics through college level engineering students. Concepts taught and/or reinforced by this design-build experience include: fluid statics, buoyancy and stability; strength of materials; machinery design, friction, and power transmission; and fluid drag resistance of various shapes. This article is structured to provide a general overview of the supporting theory and key terminology, resources for additional information, project rules for the student teams, and a supplies list for executing this project. Where possible, the references cited are commonly available at public or larger high school libraries.
Author
*Propellers; Windpower Utilization; Windpowered Generators; Mechanical Properties; Boats*

**20020066456** NASA Marshall Space Flight Center, Huntsville, AL USA
**Small Particle Response to Fluid Motion using Tethered Particles to Simulate Microgravity**
Trolinger, J. D., NASA Marshall Space Flight Center, USA; Rangel, R., NASA Marshall Space Flight Center, USA; Coimbra, C., NASA Marshall Space Flight Center, USA; Witherow, W., NASA Marshall Space Flight Center, USA; Rogers, J. R., NASA Marshall Space Flight Center, USA; Lal, R. B., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; Microgravity Materials Science Conference, 25 Jun. 2002, Huntsville, AL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

This paper reports on ground based work conducted to support the Spaceflight Definition project SHIVA (Spaceflight Holography Investigation in a Virtual Apparatus). SHIVA will advance our understanding of the movement of a particle in a fluid. Gravity usually dominates the equations of motion, but in microgravity as well as on earth other terms can become important. Before two members of our team found an analytical solution of the equations, numerical methods and/or neglecting terms were required. The general solution predicts that the usually neglected history term becomes important when the characteristic viscous time is in the same order as the vibration period and peaks when the two times are equal. In this case three force terms, the Stokes drag, the added mass, and the history drag must all be included in predicting particle movement. We also developed diagnostic recording methods using holography to save all of the particle field data, allowing the experiment to essentially be transferred from space back to earth in what we call the "virtual apparatus". Using state-of-the-art methods in holography we will quantify the three-dimensional motion of sets of particles, allowing us to test and apply the new analytical solutions. The motion of particles up to 4 mm in diameter in a fluid that oscillates at frequencies up to 100 Hz with amplitudes up to 200 microns is being examined. Ground studies to support the flight development program have employed various schemes to simulate microgravity. One of the most reliable and meaningful methods uses spheres tethered to a fine hair suspended in the fluid. We have also investigated particles with nearly neutral buoyancy. Recordings are made at the peak amplitudes of vibration of the cell providing a measure of the ratio of fluid to particle amplitude. The experiment requires precise location of the particle at the time of recording. The hologram of the particle provides microscopic images of the particle that are used for finding the position with an accuracy of a few microns. to make the experiment more versatile, the spaceflight system will record holograms both on film and electronically. The electronic holograms can be downlinked providing real time data. Results of the ground experiments, the flight experiment design, and data analysis procedures are reported.
Author
*Particle Motion; Microgravity; Holography; Microparticles; Space Flight*

**20020066495** Analytical Methods, Inc., USA

**Go With the Flow**

Spinoff 2000; 2000, pp. 72; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

Based on work begun in the 1970s, Analytical Methods, Inc. (AMI) developed computational fluid dynamics (CFD) technology called VSAERO. VSAERO can image aerodynamic flows and has been used in a number of unique designs such as the U.S. sailboat used in the 1996 America's Cup, solar automobiles, and solar airplaces. VSAERO is applicable to fluid flow problems in aerospace, aeronautical, automotive, and marine engineering.

Author

*Technology Utilization; Computational Fluid Dynamics; Fluid Flow; Applications Programs (Computers); Computerized Simulation; Flow Visualization*

**20020066539** Technical Research Centre of Finland, Valtion Teknillinen Tutkimuskeskus, Espoo, Finland

**Numerical Treatment of Inter-Phase Coupling and Phasic Pressures in Multi-Fluid Modelling**

Karema, H.; Mar. 01, 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): PB2002-107030; VTT/PUB-458; No Copyright; Avail: National Technical Information Service (NTIS)

This thesis work concentrates on the area of dispersed multi-phase flows and, especially, to the problems encountered while solving their governing equations numerically with a collocated Control Volume Method (CVM). to allow flexible description of geometry all treatment is expressed in a form suitable for local Body Fitted Coordinates (BFC) in a multi-block structure. All work is related to conditions found in a simplified fluidized bed reactor. The problems covered are the treatment and efficiency of inter-phase coupling terms in sequential solution, the exceeding of the bounds of validity of the shared pressure concept in cases of high dispersed phase pressure and the conservation of mass in momentum interpolation for rapidly changing source terms.

NTIS

*Fluid Dynamics; Numerical Analysis; Multiphase Flow; Models*

**20020066587** Massachusetts Inst. of Tech., Lincoln Lab., Lexington, MA USA

**Surface Oscillations of An Electromagnetically Levitated Droplet**

Berry, S., Massachusetts Inst. of Tech., USA; Curreri, Peter A., NASA Marshall Space Flight Center, USA; Hyers, R. W., Axsun Technologies, Inc., USA; Racz, L. M., Axsun Technologies, Inc., USA; Abedian, B., Tufts Univ., USA; [2002]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Oscillating droplets are of interest in a number of disciplines. A practical application is the oscillating drop method, which is a technique for measuring surface tension and viscosity of liquid metals. It is especially suited to undercooled and highly reactive metals, because it is usually performed by electromagnetic levitation. The natural oscillation frequency a f the droplets is related to the surface tension of the material, and the decay of oscillations is related to its viscosity. The fluid flow inside the droplet must be laminar in order for this technique to yield good results. Because no experimental method has yet been developed to visualize flow in electromagnetically-levitated oscillating metal droplets, mathematical modeling is required to determine whether or not turbulence occurs. Three mathematical models of the flow: (1) assuming laminar conditions, (2) using the turbulence model, and (3) using the RNG turbulence model, respectively, are compared and contrasted to determine the physical characteristics of the flow. It is concluded that the RNG model is the best suited for describing this problem. The goal of the presented work was to characterize internal flow in an oscillating droplet of liquid metal, and to verify the accuracy of the characterization by comparing calculated surface tension and viscosity values to experimentally-obtained results.

Author

*Drops (Liquids); Electromagnets; Levitation; Oscillations; Interfacial Tension*

**20020066633** Argonne National Lab., IL USA

**Flow of a Two-Dimensional Liquid Metal Jet in a Strong Magnetic Field**

Molokov, S.; Reed, C. B.; 2002; 20p; In English

Report No.(s): DE2002-42098; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Two-dimensional, steady flow of a liquid metal slender jet pouring from a nozzle in the presence of a transverse, nonuniform magnetic field is studied. The surface tension has been neglected, while gravity is shown to be not important. The main aim of the study is to evaluate the importance of the inertial effects. It has been shown that for gradually varying fields characteristic for the divertor region of a tokamak, inertial effects are negligible for N greater than 10, where N is the interaction parameter. Thus the inertialess flow model is expected to give good results even for relatively low magnetic fields and high jet velocity. Simple

relations for the jet thickness and velocity have been derived. The results show that the jet becomes thicker if the field increases along the flow and thinner if it decreases.
NTIS
*Liquid Metals; Nonuniform Magnetic Fields; Steady Flow; Two Dimensional Flow*

**20020066686** Department of Energy, Washington, DC USA
**Engineering Development of Slurry Bubble Column Reactor (SBCR) Technology** ***Final Report, 1 Oct. - 31 Dec. 1999***
Toseland, B. A.; Kornosky, R. M.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-793999; No Copyright; Avail: National Technical Information Service (NTIS)
The major technical objectives of this program are threefold: (1) to develop the design tools and a fundamental understanding of the fluid dynamics of a slurry bubble column reactor to maximize reactor productivity, (2) to develop the mathematical reactor design models and gain an understanding of the hydrodynamic fundamentals under industrially relevant process conditions, and (3) to develop an understanding of the hydrodynamics and their interaction with the chemistries occurring in the bubble column reactor. Successful completion of these objectives will permit more efficient usage of the reactor column and tighter design criteria, increase overall reactor efficiency, and ensure a design that leads to stable reactor behavior when scaling up to large diameter reactors.
NTIS
*Bubbles; Reactors*

**20020066702** Institute for Computer Applications in Science and Engineering, Hampton, VA USA
**Constitutive Modeling of Nanotube-Reinforced Polymer Composites** ***Final Report***
Odegard, G. M., Institute for Computer Applications in Science and Engineering, USA; Gates, T. S., NASA Langley Research Center, USA; Wise, K. E., Institute for Computer Applications in Science and Engineering, USA; Park, C., Institute for Computer Applications in Science and Engineering, USA; Siochi, E. J., NASA Langley Research Center, USA; July 2002; 36p; In English
Contract(s)/Grant(s): NAS1-97046; RTOP 505-90-52-01
Report No.(s): NASA/CR-2002-211760; NAS 1.26:2002-211760; ICASE-2002-27; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
In this study, a technique is presented for developing constitutive models for polymer composite systems reinforced with single-walled carbon nanotubes (SWNT). Because the polymer molecules are on the same size scale as the nanotubes, the interaction at the polymer/nanotube interface is highly dependent on the local molecular structure and bonding. At these small length scales, the lattice structures of the nanotube and polymer chains cannot be considered continuous, and the bulk mechanical properties can no longer be determined through traditional micromechanical approaches that are formulated by using continuum mechanics. It is proposed herein that the nanotube, the local polymer near the nanotube, and the nanotube/polymer interface can be modeled as an effective continuum fiber using an equivalent-continuum modeling method. The effective fiber serves as a means for incorporating micromechanical analyses for the prediction of bulk mechanical properties of SWNT/polymer composites with various nanotube lengths, concentrations, and orientations. As an example, the proposed approach is used for the constitutive modeling of two SWNT/polyimide composite systems.
Author
*Carbon Nanotubes; Polymers; Molecular Structure; Bonding; Composite Structures; Continuum Modeling*

**20020067454** NASA Marshall Space Flight Center, Huntsville, AL USA
**Small Particle Response to Fluid Motion using Tethered Particles to Simulate Microgravity**
Trolinger, J. D., NASA Marshall Space Flight Center, USA; Rangel, R., NASA Marshall Space Flight Center, USA; Coimbra, C., NASA Marshall Space Flight Center, USA; Witherow, W., NASA Marshall Space Flight Center, USA; Rogers, J. R., NASA Marshall Space Flight Center, USA; Lal, R. B., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; Microgravity Materials Science Conference, 25 Jun. 2002, Huntsville, AL, USA; No Copyright; Avail: Issuing Activity; Abstract Only
This paper reports on ground based work conducted to support the Spaceflight Definition project SHIVA (Spaceflight Holography Investigation in a Virtual Apparatus). SHIVA will advance our understanding of the movement of a particle in a fluid. Gravity usually dominates the equations of motion, but in microgravity as well as on earth other terms can become important. Before two members of our team found an analytical solution of the equations, numerical methods and/or neglecting terms were required. The general solution predicts that the usually neglected history term becomes important when the characteristic viscous time is in the same order as the vibration period and peaks when the two times are equal. In this case three force terms, the Stokes drag, the added mass, and the history drag must all be included in predicting particle movement. We also developed diagnostic

recording methods using holography to save all of the particle field data, allowing the experiment to essentially be transferred from space back to earth in what we call the ”virtual apparatus”. Using state-of-the-art methods in holography we will quantify the three-dimensional motion of sets of particles, allowing us to test and apply the new analytical solutions. The motion of particles up to 4 mm in diameter in a fluid that oscillates at frequencies up to 100 Hz with amplitudes up to 200 microns is being examined. Ground studies to support the flight development program have employed various schemes to simulate microgravity. One of the most reliable and meaningful methods uses spheres tethered to a fine hair suspended in the fluid. We have also investigated particles with nearly neutral buoyancy. Recordings are made at the peak amplitudes of vibration of the cell providing a measure of the ratio of fluid to particle amplitude. The experiment requires precise location of the particle at the time of recording. The hologram of the particle provides microscopic images of the particle that are used for finding the position with an accuracy of a few microns. to make the experiment more versatile, the spaceflight system will record holograms both on film and electronically. The electronic holograms can be downlinked providing real time data. Results of the ground experiments, the flight experiment design, and data analysis procedures are reported.
Author
*Equations of Motion; Holography; Microgravity; Particle Motion; Drag*

## 35
## INSTRUMENTATION AND PHOTOGRAPHY

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

**20020065344** Defence Science and Technology Organisation, Electronics and Surveillance Research, Salisbury, Australia
**Inverting the Circular Radon Transform**
Redding, Nicholas J.; Newsam, Garry N.; Aug. 2001; 59p; In English
Report No.(s): AD-A403500; DSTO-RR-0211; DODA-AR-011-855; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

In this report we show how image formation or reconstruction in synthetic aperture radar (SAR) can be viewed as the inversion of the circular Radon transform. The advantage of viewing image formation in this way is that it could be used in situations where more standard methods could fail such as high squint and ultra-wideband SAR. We examine previous work in the literature on circular Radon transforms and their inversion. Next, we present some novel techniques and analytic expressions for the transform of some key functions. We briefly consider motion compensation. Finally, we propose a number of possible methods that could be pursued to make new practical image formation algorithms.
DTIC
*Image Processing; Synthetic Aperture Radar; Transformations (Mathematics); Image Reconstruction; Radon*

**20020065513** Boston Univ., Boston, MA USA
**An Integrated Approach to Reduced Signature Target Recognition**
Castanon, David A.; Mar. 31, 2002; 5p; In English
Contract(s)/Grant(s): F49620-96-1-0028
Report No.(s): AD-A403710; AFRL-SR-AR-TR-02-0168; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The scientific results provided significant unification of theories from computer vision and statistical pattern recognition with physics-based models of ATR sensors, as well as extensions of mathematical signal processing techniques such as multiresolution representations to ATR relevant domains. The research has laid the foundation for many years of exploration of new approaches to ATR in reduced signature environments. The research has also developed important technologies to address future hard ATR problems that are of critical DoD interest. These problems include detection of buried objects such as plastic mines, or bunkers, classification of targets in difficult environments such as under tree, recognition of highly variable targets in complex environments, and integration of information from multiple sensors. These techniques are ideal for future DoD and Air Force capabilities based on the proliferation of sensors in order to achieve information dominance.
DTIC
*Target Recognition; Signature Analysis*

**20020066263** NASA Glenn Research Center, Cleveland, OH USA

**International Space Station Increment-3 Microgravity Environment Summary Report**

Jules, Kenol, NASA Glenn Research Center, USA; Hrovat, Kenneth, ZIN Technologies, Inc., USA; Kelly, Eric, ZIN Technologies, Inc., USA; McPherson, Kevin, NASA Glenn Research Center, USA; Reckart, Timothy, ZIN Technologies, Inc., USA; Grodsinksy, Carlos, ZIN Technologies, Inc., USA; June 2002; 156p; In English; Original contains color illustrations

Contract(s)/Grant(s): RTOP 400-35-40

Report No.(s): NASA/TM-2002-211693; NAS 1.15:211693; E-13424; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This summary report presents the results of some of the processed acceleration data measured aboard the International Space Station during the period of August to December 2001. Two accelerometer systems were used to measure the acceleration levels for the activities that took place during Increment-3. However, not all of the activities were analyzed for this report due to time constraint and lack of precise timeline information regarding some payload operations and station activities. The National Aeronautics and Space Administration sponsors the Microgravity Acceleration Measurement System and the Space Acceleration Microgravity System to support microgravity science experiments which require microgravity acceleration measurements. On April 19, 2001, both the Microgravity Acceleration Measurement System and the Space Acceleration Measurement System units were launched on STS-100 from the Kennedy Space Center for installation on the International Space Station. The Microgravity Acceleration Measurement System unit was flown to the station in support of science experiments requiring quasi-steady acceleration measurements, while the Space Acceleration Measurement System unit was flown to support experiments requiring vibratory acceleration measurement. Both acceleration systems are also used in support of the vehicle microgravity requirements verification. The International Space Station Increment-3 reduced gravity environment analysis presented in this report uses acceleration data collected by both sets of accelerometer systems: (1) The Microgravity Acceleration Measurement System, which consists of two sensors: the Orbital Acceleration Research Experiment Sensor Subsystem, a low frequency range sensor (up to 1 Hz), is used to characterize the quasi-steady environment for payloads and vehicle, and the High Resolution Accelerometer Package, which is used to characterize the vibratory environment up to 100 Hz. (2) The Space Acceleration Measurement System, which is a high frequency sensor, measures vibratory acceleration data in the range of 0.01 to 400 Hz. This summary report presents analysis of some selected quasi-steady and vibratory activities measured by these accelerometers during Increment-3 from August to December, 2001.

Author

*International Space Station; Accelerometers; Microgravity; Acceleration Measurement; Space Technology Experiments*

**20020066326** Wisconsin Univ., Dept. of Chemistry, Madison, WI USA

**Magnetic Field Sensing Experiments Based on a Commercially Available Giant Magnetoresistive (GMR) Sensor**

Payne, Amy, Wisconsin Univ., USA; Schnell, Kara A., Wisconsin Univ., USA; Himpsel, Franz J., Wisconsin Univ., USA; Ellis, Arthur B., Wisconsin Univ., USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 181-191; In English; Also announced as 20020066311

Contract(s)/Grant(s): NSF DMR-00-79983; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

The experiments being presented are based on a relatively inexpensive, commercially available giant magnetoresistive (GMR) sensor. Magnetoresistance is a phenomenon in which the resistance of a material changes in response to an applied magnetic field. All metals display a small magnetoresistance; however, magnetic multilayers with nanoscale dimensions can display a large magnetoresistance called GMR, which is based on the magnetic reversal of individual layers in the stack. GMR has found its way into many important applications. GMR devices are currently being used as magnetic sensors in the read heads of computer disk drives, as motion sensors in automobiles, and in biosensing assays. Students will be introduced to GMR concepts and applications by: 1. using a GMR sensor to determine patterns of magnetic fields from a series of refrigerator magnets; 2. observing the GMR effect, calculating the percentage change in resistance of a material in response to a magnetic field, and determining how temperature affects the GMR effect; and 3. designing an application for the GMR sensor.

Author

*Detection; Magnetic Fields; Magnetoresistivity; Magnets*

**20020066331** Universidad Nacional Autonoma de Mexico, Inst. for Materials Research, Mexico City, Mexico

**Magnetoimpedance: A Useful Phenomenon for Magnetic, Electric and Stress Sensors**

Valenzuela, Raul, Universidad Nacional Autonoma de Mexico, Mexico; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 265-275; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

When a conducting ferromagnetic material (best results have been obtained with amorphous wires and ribbons in the CoFeBSi system) is subjected to an AC current of small amplitude (less than 10 mA RMS to avoid any heating of the sample), it shows an impedance larger than the value corresponding solely to its DC resistance. If a DC magnetic field is applied, the impedance decreases to a value very close to the DC conditions. The impedance change increases as the current frequency increases, and is quite sensitive to the DC magnetic field. This phenomenon is known as Giant Magnetoimpedance (GMI) and has attracted much interest due both to its technological applications in magnetic field sensors, and to its basic electromagnetic nature.
Author
*Electric Fields; Ferromagnetic Materials; Impedance; Electromagnetism; Magnetic Permeability; Sensors*

**20020066594** NASA Goddard Space Flight Center, Greenbelt, MD USA
**Cloud Physics Lidar: Instrument Description and Initial Measurement Results**
McGill, Matthew, NASA Goddard Space Flight Center, USA; Hlavka, Dennis, Science Systems and Applications, Inc., USA; Hart, William, Science Systems and Applications, Inc., USA; Scott, V. Stanley, NASA Goddard Space Flight Center, USA; Spinhirne, James, NASA Goddard Space Flight Center, USA; Schmid, Beat, Bay Area Environmental Research Inst., USA; Applied Optics; Jun. 20, 2002; ISSN 0003-6935; Volume 41, No. 18, pp. 3725; In English
Contract(s)/Grant(s): NCC2-1094; Copyright; Avail: Issuing Activity; Abstract Only
The Cloud Physics Lidar (CPL) is a new custom-built instrument for the NASA ER-2 high-altitude aircraft. The CPL can provide multiwavelength measurements of cirrus, subvisual cirrus, and aerosols with high temporal and spatial resolution. Its state-of-the-art technology gives it a high repetition rate, and photon-counting detection, and includes a low-pulse-energy laser. The CPL was first deployed at the Southern African Regional Science Initiative's 2000 field campaign during August and September 2000. This paper provides an overview of the instrument and initial data results to illustrate the measurement capability of the CPL.
CASI
*Optical Radar; Cloud Physics; Pulsed Lasers; In Situ Measurement*

## 36
## LASERS AND MASERS

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

**20020065355** Lightwave Electronics Corp., Mountain View, CA USA
**Diode-Pumped Mode-Locked LiSAF Laser** ***Final Report***
Feb. 1996; 36p; In English
Report No.(s): DE2002-761915; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Contents include the following: Summary; Background and Motivation; Laboratory Results (100 MHz Cavity, 500 MHz Cavity, 532nm pumping results); Improved Diode Pumping; New Diode based Solid State Pump Source; (System Design and Optical challenges, Mechanical, Electronics); Mounting and Control Module; Conclusion and Future Direct; References.
NTIS
*Solid State Lasers; Lasers; Diodes*

**20020065378** Physics and Electronics Lab. TNO, The Hague, Netherlands
**Laser Technology for Target Designated and Combat-ID** ***Final Report***
vandenHeuvel, J. C., Physics and Electronics Lab. TNO, Netherlands; vanPutten, F. J. M., Physics and Electronics Lab. TNO, Netherlands; vanBezooijen, J. A. G., Physics and Electronics Lab. TNO, Netherlands; July 2001; 72p; In English
Contract(s)/Grant(s): A98/KL/618; TNO Proj. 27371
Report No.(s): TD00-0470; FEL-01-A103; Copyright; Avail: Issuing Activity
Experimental methods have been developed for the characterisation of laser target designators. A performance model was made in order to analyse the results. A laser combat-ID system based on a 1.54 micrometer laser vibrometry system was modified

by the incorporation of fiber component leading to a ruggedised system. Laboratory test show an excellent sensitivity of the system.
Author
*Combat; Laser Target Designators; Laser Applications; Vibration Meters; Systems Engineering*

**20020065439** Lawrence Livermore National Lab., Livermore, CA USA
**Mercury and Beyond: Diode-Pumped Solid-State Lasers for Inertial Fusion Energy**
Bibeau, C.; Beach, R. J.; Bayramian, A.; Chanteloup, J. C.; Ebbers, C. A.; Oct. 19, 1999; 18p; In English
Report No.(s): DE2002-792300; UCRL-JC-133970; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
We have begun building the 'Mercury' laser system as the first in a series of new generation diode-pumped solid-state lasers for inertial fusion research. Mercury will integrate three key technologies: diodes, crystals, and gas cooling, within a unique laser architecture that is scalable to kilojoule energy levels for fusion energy applications. The primary performance goals include 10% electrical efficiencies at 10 Hz and 100 J with a 2-10 ns pulse length at 1.047 pm wavelength. When completed, Mercury will allow rep-rated target experiments with multiple target chambers for high energy density physics research.
NTIS
*Solid State Lasers; Mercury (Metal); Thermonuclear Power Generation*

**20020065523** Florida Atlantic Univ., Dept. of Mechanical Engineering, Boca Raton, FL USA
**Thermal-Fluid Analysis and Simulation of High Power Solid-State Laser Diode (SLD) Assemblies** ***Interim Report, 1 Jan.-30 Apr. 2002***
Liou, L. L.; Tsai, C. T.; Zhu, X. A.; Jun. 2002; 7p; In English
Contract(s)/Grant(s): F33615-95-C-1614; Proj-2432
Report No.(s): AD-A403691; AFRL-SN-WP-TP-2002-103; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
The thermal configuration is an important factor determining the successful operation of the high power solid-state laser diode assemblies. The solid-state diode array in an H-package using a conventional water-cooling flow was analyzed using a combined thermal and fluid finite element codes. A successful convergent solution was reached for the typical operation conditions. The results of the temperature and fluid velocity fields were reported and were compared reasonably with the experimental results.
DTIC
*Diodes; Solid State Lasers*

**20020066419** Ames Lab., IA USA
**Laser: a toll for Optimization and Enhancement of Analytical Methods**
Preisler, J.; Jan. 10, 1997; 160p; In English
Report No.(s): DE2002-793817; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
In this work, we use lasers to enhance possibilities of laser desorption methods and to optimize coating procedure for capillary electrophoresis (CE). We use several different instrumental arrangements to characterize matrix-assisted laser desorption (MALD) at atmospheric pressure and in vacuum. In imaging mode, 488-nm argon-ion laser beam is deflected by two acousto-optic deflectors to scan plumes desorbed at atmospheric pressure via absorption. All absorbing species, including neutral molecules, are monitored. Interesting features, e.g. differences between the initial plume and subsequent plumes desorbed from the same spot, or the formation of two plumes from one laser shot are observed. Total plume absorbance can be correlated with the acoustic signal generated by the desorption event. A model equation for the plume velocity as a function of time is proposed. Alternatively, the use of a static laser beam for observation enables reliable determination of plume velocities even when they are very high. Static scattering detection reveals negative influence of particle spallation on MS signal. Ion formation during MALD was monitored using 193-nm light to photodissociate a portion of insulin ion plume. These results define the optimal conditions for desorbing analytes from matrices, as opposed to achieving a compromise between efficient desorption and efficient ionization as is practiced in mass spectrometry. In CE experiment, we examined changes in a poly(ethylene oxide) (PEO) coating by continuously monitoring the electroosmotic flow (EOF) in a fused-silica capillary during electrophoresis. An imaging CCD camera was used to follow the motion of a fluorescent neutral marker zone along the length of the capillary excited by 488-nm Ar-ion laser. The PEO coating was shown to reduce the velocity of EOF by more than an order of magnitude compared to a bare capillary at pH 7.0. The coating protocol was important, especially at an intermediate pH of 7.7. The increase of pH in the cathodic (detection-end) buffer reservoir beyond pH (approx)8.0, e.g. as a result of electrolysis, had a large impact on the stability of the coating. This phenomenon may be used for the efficient and reliable fast regeneration of the column surface.
NTIS
*Lasers; Procedures*

**20020066435** Cutting Edge Optronics, Inc., Saint Charles, MO USA

**Pumped up Lasers**

Spinoff 2000; 2000, pp. 85; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

Cutting Edge Optronics released the first of potentially three products to result from an SBIR contract with Goddard Space Flight Center. The first commercial result is the WhisperMiniSlab, a diode pump for high performance laser systems. The slab uses a zig-zag path through the laser crystal which eliminates the need for thermal lensing. The result is smaller lasers with better beam quality for use in medical and industrial applications.

Author

*Technology Utilization; Laser Pumping; Semiconductor Lasers*

**20020066467** SpectraSensors, Inc., Altadena, CA USA

**A Little Sensor That Packs a Wallop**

Spinoff 2000; 2000, pp. 80; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

A gas sensor originally built for NASA to measure the composition of the atmosphere of Earth and Mars has been commercialized by SpectraSensors. The commercial tunable diode laser (TDL) gas sensor can be used for oil and gas pipeline monitoring, aircraft safety, environmental monitoring and medicine. The TDL technology is good at detecting low levels of gases from parts-per-million to parts-per-billion.

Author

*Technology Utilization; Gas Detectors; Tunable Lasers; Semiconductor Lasers*

## 37
## MECHANICAL ENGINEERING

*Includes mechanical devices and equipment; machine elements and processes. For cases where the application of a device or the host vehicle is emphasized see also the specific category where the application or vehicle is treated. For robotics see 63 Cybernetics, Artificial Intelligence, and Robotics; and 54 Man/System Technology and Life Support.*

**20020066193** Helsinki Univ. of Technology, Lab. of Electromechanics, Espoo, Finland

**Oscillating Electrical Machines: Postgraduate Seminar on Electromechanics Otaniemi 20-21.11.2001**

Kudarauskas, S.; Jun. 2001; 58p; In English

Report No.(s): PB2002-105004; FOI-R-0061-SE; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

The main objective of the course is an acquaintance with oscillating electrical machines, which are distinguished by specific properties of mechanical movement. The classification of oscillating machines as an independent class is based on the properties of mechanical movement. The analysis of oscillating machines in this course is related to the general principles of electrical machines. The specific properties of oscillating machines stimulate to take a non-traditional look at the general issues on electrical machines. So, the critical point of view on settled traditions is sometimes unavoidable in this course. The secondary objectives of the course are the following: (1) to analyze the classification of electrical machines by the properties of mechanical movement and the expediency of a corresponding classification; (2) to provide acquaintance with general laws of energy conversion and their application for the analysis of electrical machines; (3) To take notice of the problems of analogy between electrical and magnetic circuits; (4) to take notice of the variety and unity of electrical machines.

NTIS

*Cracking (Fracturing); Stress Measurement; Electric Motors; Conferences; Electromechanics; Oscillations*

**20020066266** Institute of Industrial Technology TNO, Apeldoorn, Netherlands

**Optimizing of the Welding Activities, Part 1, Preparing *Final Report Optimaliseren van de Laswerkzaamheden, Deel 1, Voorbereiding***

Schat, F., Institute of Industrial Technology TNO, Netherlands; Jan. 18, 2002; 29p; In Dutch

Contract(s)/Grant(s): A01/KL/119; DO-13761; TNO Proj. 007/60648/01.01

Report No.(s): TD-2002-0086; TNO-01I-01281-1; Copyright; Avail: Issuing Activity

The Mechanisch Centrale Werkplaats (MCW) is working on a further improvement of the welding quality assurance of repair, maintenance and constructing components. Investigated is which work has to be done to upgrade the present-day welding quality requirements according to the requirements mentioned in the current European welding standards. The important part of the

quality system is the welding qualifications of different materials: construction steel St52/S355, high strength steel, armor steel and aluminium alloys. In consultation with the MCW the following work has to be carried out for welding: a) Approval testing of welders: It concerns the approval testing of welders according to NEN-EN 287-1 for steel and NEN-EN 287-2 for aluminium alloys. b) Welding procedure qualification record (WPQR): The aim is testing the actual mechanical properties of the weldments. It concerns the welding procedure qualification record (WPQR) according to NEN-EN 288-3 for steel and NEN-EN 288-4 for aluminium alloys.
Author
*Welding; Specifications; Mechanical Properties; Optimization; High Strength Steels*

**20020066284** Department of Energy, Office of Heavy Vehicle Technologies, Washington, DC USA
**Crafting a Common Vision for the Off-highway Vehicles of the Future**
Apr. 19, 2001; In English; This document is color dependent and/or in Landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-771150; No Copyright; Avail: National Technical Information Service (NTIS)
The report discusses the Department of Energy, Office of Heavy Vehicle Technologies, whose mission is to conduct, in collaboration with our heavy vehicle industry partners and their suppliers, a customer-focused national program to research and develop technologies that will enable trucks and other heavy vehicles to be more energy efficient and able to use alternative fuels while simultaneously reducing emissions.
NTIS
*Research and Development; Motor Vehicles; Energy Technology; Energy Policy; Technology Assessment*

**20020066306** Department of Energy, Office of Heavy Vehicle Technologies, Washington, DC USA
**Overview of the DOE Heavy Vehicle Technologies R and D Program. January 30-31, 2001**
Eberhardt, J. J.; Jan. 2001; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-771146; No Copyright; Avail: National Technical Information Service (NTIS)
The report discusses the Department of Energy, Office of Heavy Vehicle Technologies, whose mission is to conduct, in collaboration with our heavy vehicle industry partners and their suppliers, a customer-focused national program to research and develop technologies that will enable trucks and other heavy vehicles to be more energy efficient and able to use alternative fuels while simultaneously reducing emissions.
NTIS
*Trucks; Research and Development; Motor Vehicles; Energy Technology; Mechanical Devices*

**20020066325** California State Univ., Dept. of Mechanical Engineering, Los Angeles, CA USA
**Determination of Redundant Work in Extrusion Using Visio-Plasticity**
Fabris, Neda S., California State Univ., USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 171-179; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche
In the extrusion process the billet is forced through a die with a substantial reduction, the friction between the billet and the die causes the retardation of the material close to the die and surface of the cylinder, causing non-uniform material flow pattern. That pattern is highly influenced by the die angle, friction coefficient between die and material extruded and temperature of the material.
Derived from text
*Extruding; Plastic Properties; Billets; Flow Distribution*

**20020066349** Wright State Univ., Emeritus of Chemistry, Dayton, OH USA
**Demonstrations of Some Fundamental Concepts Concerning Fuels and Engines**
Fortman, John J., Wright State Univ., USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 495-504; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche
In order to produce combustion one needs a fuel, a source of oxygen, and an initiator. This is presented in a surprising manner using a burning book while relating this information. Carbon dioxide and oxygen gases are produced to illustrate the difference between gases which do or do not support combustion. The vapor nature of burning is illustrated with a demonstration which dates back to Michael Faraday and his lectures on the candle. This open burning of fuel vapor which occurs when the fuel and oxygen come from different sources and bum at the interface of mixing is contrasted to explosions which occur when the fuel and oxygen

gases are pre-mixed. Since oxygen is the limiting reagent there is a need for an exhaust stroke in order to have repeated explosions which produce thrust. The timing cycle in a four-cylinder four-stroke internal combustion engine is shown by a participatory analogy. A visual illustration is presented comparing a rapid rough explosion and a slower smooth explosion and the difference is related to the octane rating of fuels for anti-knock.
Derived from text
*Antiknock Additives; Combustion; Fuels; Internal Combustion Engines; Analogies*

**20020066398** Department of Energy, Office of Heavy Vehicle Technologies, Washington, DC USA
**Overview of the DOE Heavy Vehicle Technologies R and D Program**
Apr. 23, 2001; In English; This document is color dependent and/or in Landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-771151; No Copyright; Avail: National Technical Information Service (NTIS)
The mission is to conduct, in collaboration with the heavy vehicle industry partners and their suppliers, a customer-focused national program to research and develop technologies that will enable trucks and other heavy vehicles to be more energy efficient and capable of using alternative fuels while simultaneously reducing emissions.
NTIS
*Trucks; Research and Development; Technology Assessment*

**20020066400** Department of Energy, Office of Heavy Vehicle Technologies, Washington, DC USA
**Overview of the DOE Heavy Vehicle Technologies R and D Program**
May 30, 2001; In English; This document is color dependent and/or in Landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-771159; No Copyright; Avail: National Technical Information Service (NTIS)
International pressure to reduce transportation carbon dioxide emissions is providing a driving force favoring use of high efficiency diesel engines. Environmental groups question increasing use of diesel engines. Laboratory experiments indicate that the diesel engine with new control technologies, in conjunction with very low sulfur diesel fuel, can attain very low emission levels comparable to those of conventional gasoline engines. Cost-effective emissions control can be achieved with three-pronged systems approach, i.e., simultaneously addressing fuels formulation, in-cylinder combustion control.
NTIS
*Vehicles; Research and Development; Technology Assessment; Combustion Control; Diesel Fuels*

**20020066401** Department of Energy, Office of Heavy Vehicle Technologies, Washington, DC USA
**Essential Power Systems for Heavy Vehicles of the Future Workshop**
Dec. 2001; In English, 12-13 Dec. 2001, Washington, DC, USA; This document is color dependent and/or in Landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-771158; No Copyright; Avail: National Technical Information Service (NTIS)
This document presents a meeting on the engines, vehicle systems, and fuels and lubrication technologies.
NTIS
*Fuels; Lubrication; Vehicles*

**20020066442** Hydro Dynamics, Inc., Rome, GA USA
**A Shocking New Pump**
Spinoff 2000; 2000, pp. 76-77; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.
Hydro Dynamics, Inc. received a technical helping hand from NASA that made their Hydrosonic Pump (HPump) a reality. Marshall engineers resolved a bearing problem in the rotor of the pump and recommended new bearings, housings and mounting hardware as a solution. The resulting HPump is able to heat liquids with greater energy efficiency using shock waves to generate heat.
Author
*Technology Utilization; Shock Waves; Pumps; Hydrodynamics; Thermal Energy*

**20020066465** Department of Energy, Office of Heavy Vehicle Technologies, Washington, DC USA
**DOE Goals and Perspectives on Lean-Burn Emissions Controls**
Singh, G.; May 08, 2001; In English; This document is color dependent and/or in Landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-771154; No Copyright; Avail: National Technical Information Service (NTIS)

This publication discusses the engine technologies, the vehicle system technologies, and fuels and lubrication technologies. High-efficiency clean diesel-cycle engines utilize compression ignitable clean fuels/blends from diverse feedstocks.
NTIS
*Emission; Pollution Control; Trucks; Research and Development; Clean Fuels*

**20020066469** M and A Screw and Machine Works, Philadelphia, PA USA
**A Faster Fastener**
Spinoff 2000; 2000, pp. 75; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.
A licensing agreement between Marshall Space Flight Center and M&A Screw and Machineworks has brought the quick connect nut to the commerical market. Originally designed as part of a project seeking in-space assembly techniques, the quick connect nut is secured around a bolt merely by pushing it onto the bolt and giving it a single twist. Applications for the nuts include oil drilling platforms, mining industry, and other practices that rely on speedy assembly for success.
Author
*Technology Utilization; Bolts; Orbital Assembly; Nuts (Fasteners)*

**20020066472** Department of Energy, Office of Heavy Vehicle Technologies, Washington, DC USA
**Engines that Will Power the Future**
Nov. 12, 2001; In English; This document is color dependent and/or in Landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-771156; No Copyright; Avail: National Technical Information Service (NTIS)
The mission is to conduct, in collaboration with the heavy vehicle industry partners and their suppliers, a customer-focused national program to research and develop technologies that will enable trucks and other heavy vehicles to be more energy efficient and able to use alternative fuels while simultaneously reducing emissions.
NTIS
*Engines; Research and Development; Efficiency; Energy Policy; Trucks*

**20020066474** Department of Energy, Office of Heavy Vehicle Technologies, Washington, DC USA
**Overview of the DOE Heavy Vehicle Technologies R and D Program**
May 02, 2001; In English; This document is color dependent and/or in Landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-771152; No Copyright; Avail: National Technical Information Service (NTIS)
The office of heavy vehicle technologies created in the DOE/Office of Transportation technologies restructing in March 1998. It also focuses research and development on critical areas identified with heavy vehicle customers.
NTIS
*Trucks; Research and Development; Transportation; Technology Assessment*

**20020066657** Lockheed Martin Michoud Space Systems, New Orleans, LA USA
**NDE of Friction Stir Welds in Aerospace Applications**
Kinchen, David G., Lockheed Martin Michoud Space Systems, USA; Aldahir, Esma, Lockheed Martin Michoud Space Systems, USA; July 2002; 7p; In English
Contract(s)/Grant(s): NAS8-00016; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
Friction Stir Welding (FSW) is a solid state joining process, which utilizes a cylindrical, shouldered pin tool with a radiused tip that is rotated and plunged into the weld joint. Frictional heating beneath the shoulder, and surrounding the pin tip causes the material to plasticize, intermix and consolidate into a weldment without melting the parent material. FSW in aluminum alloys has many advantages such as low distortion and shrinkage, excellent mechanical properties, and no porosity. However, the propensity of the FSW process to create detrimental defects does exist, and is dependent on FSW parameter limits and controls. Inspection processes for FSW must also be selected and implemented concurrent with the new weld process. This paper describes the efforts by Lockheed Martin and NASA to find proper NDE techniques for detecting and characterizing the anomalies that may be caused by operating outside the envelope of optimized FSW parameters. Potential defects are identified and the results of the exploration of numerous NDE techniques including visual, liquid penetrant, multiple ultrasonic methods, eddy current and conductivity are discussed.
Author
*Friction Welding; Nondestructive Tests; Welded Joints; Aluminum Alloys*

**20020066666** Lockheed Martin Michoud Space Systems, New Orleans, LA USA

**Friction Stir Weld Inspection Through Conductivity Imaging Using Shaped Field MWM(Registered Trademark) - Arrays**

Goldfine, Neil, JENTEK Sensors, Inc., USA; Grundy, David, JENTEK Sensors, Inc., USA; Zilberstein, Vladimir, JENTEK Sensors, Inc., USA; Kinchen, David G., Lockheed Martin Michoud Space Systems, USA; [2002]; 6p; In English; AEROMAT, 10-13 Jun. 2002, Orlando, FL, USA

Contract(s)/Grant(s): NAS8-00016; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Friction Stir Welds (FSW) of Al 2195-T8 and Al 2219-T8, provided by Lockheed Martin Michoud Operations, were inspected for lack-of-penetration (LOP) defects using a custom designed MWM-Array, a multi-element eddy-current sensor. MWM (registered trademark) electrical conductivity mapping demonstrated high sensitivity to LOP as small as 0.75 mm (0.03 in.), as confirmed by metallographic data that characterized the extent of LOP defects. High sensitivity and high spatial resolution was achieved via a 37-element custom designed MWM-Array allowing LOP detection using the normalized longitudinal component of the MWM measured conductivity. This permitted both LOP detection and correlation of MWM conductivity features with the LOP defect size, as changes in conductivity were apparently associated with metallurgical features within the near-surface layer of the LOP defect zone. MWM conductivity mapping reveals information similar to macro-etching as the MWM-Array is sensitive to small changes in conductivity due to changes in microstructure associated with material thermal processing, in this case welding. The electrical conductivity measured on the root side of FSWs varies across the weld due to microstructural differences introduced by the FSW process, as well as those caused by planar flaws. Weld metal, i.e., dynamically recrystallized zone (DXZ), thermomechanically affected zone (TMZ), heat-affected zone (HAZ), and parent metal (PM) are all evident in the conductivity maps. While prior efforts had met with limited success for NDE (Nondestructive Evaluation) of dissimilar alloy, Al2219 to Al2195 FSW, the new custom designed multi-element MWM-Array achieved detection of all LOP defects even in dissimilar metal welds.

Author

*Metallography; Microstructure; Welded Joints; Fault Detection; Friction Welding; Electrical Resistivity; Aluminum Alloys*

**20020066696** Southwest Research Inst., San Antonio, TX USA

**Development of a Throttleless Natural Gas Engine** ***Final Report***

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

Report No.(s): DE2002-31141; No Copyright; Avail: National Technical Information Service (NTIS)

The primary focus of the project was to investigate methods to increase the efficiency of natural gas engines, especially under part-load conditions. This report contains details on the development of a natural gas-fueled engine capable of throttleless operation to improve part load efficiency. In-cylinder fuel-air charge stratification was pursued as the mechanism for throttleless operation. Various methods of charge stratification were investigated, including direct injection, stratified charge (DISC) and a fuel injected prechamber (FIPC). The FIPC combustion system was found to be a more practical solution to the problem of charge stratification. Performance and emissions results from this engine configuration are presented and comparisons are made between current natural gas engines and the prototype FIPC engine.

NTIS

*Fuel Injection; Internal Combustion Engines; Loads (Forces); Natural Gas; Spark Ignition*

## 38
## QUALITY ASSURANCE AND RELIABILITY

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

**20020065566** Commonwealth Scientific and Industrial Research Organization, Telecommunications and Industrial Physics, Linfield, Australia

**Development and Evaluation of Sensor Concepts for Ageless Aerospace Vehicles: Development of Concepts for an Intelligent Sensing System**

Abbott, David, Commonwealth Scientific and Industrial Research Organization, Australia; Doyle, Briony, Commonwealth Scientific and Industrial Research Organization, Australia; Dunlop, John, Commonwealth Scientific and Industrial Research Organization, Australia; Farmer, Tony, Commonwealth Scientific and Industrial Research Organization, Australia; Hedley, Mark, Commonwealth Scientific and Industrial Research Organization, Australia; Herrmann, Jan, Commonwealth Scientific and Industrial Research Organization, Australia; James, Geoff, Commonwealth Scientific and Industrial Research Organization, Australia; Johnson, Mark, Commonwealth Scientific and Industrial Research Organization, Australia; Joshi, Bhautik,

Commonwealth Scientific and Industrial Research Organization, Australia; Poulton, Geoff, Commonwealth Scientific and Industrial Research Organization, Australia; July 2002; 138p; In English
Contract(s)/Grant(s): RTOP 706-62-31-01
Report No.(s): NASA/CR-2002-211773; NAS 1.26:211773; TIPP-1517; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This report discusses issues involved in the development of an intelligent health monitoring system for a future ageless aerospace vehicle. In almost all areas, analogies with biological materials, structures, processes and behaviours have been employed to provide insight and inspiration, even in cases where biological solutions are recognized to be inadequate or inappropriate to the requirements of an ageless vehicle. It was concluded that: 1) However advanced materials and structures become, there will be a requirement for a health monitoring system. 2) System design must be holistic and integrated: sensing, data processing, communications, learning and decision-making must all be considered as part of a single intelligent system. 3) Temporary (and multi-stage) responses to damage will be important to combat rapidly occurring or rapidly escalating damage. 4) A number of important sensing and measurement issues require solution, including embedding or integration of a range of sensors into materials (sensory materials), development of passive sensors for continuous monitoring, long-term reliability and accuracy of embedded sensors, etc. 5) There is a strong preference for implementing the system intelligence as a distributed multi-agent system. 6) The communication system will need to be parsimonious, architecturally simple, dynamically reconfigurable and capable of learning. 7) Data processing will need to be carried out on multiple levels, depending on the sensed data and the information required, in order to minimize response times and communication traffic.
Author
*Aerospace Vehicles; Systems Engineering; Intelligence; Data Processing*

**20020065582** Commonwealth Scientific and Industrial Research Organization, Telecommunications and Industrial Physics, Linfield, Australia

**Development and Evaluation of Sensor Concepts for Ageless Aerospace Vehicles: Threats and Measurands**

Abbott, David, Commonwealth Scientific and Industrial Research Organization, Australia; Cunningham, Shaun, Commonwealth Scientific and Industrial Research Organization, Australia; Daniels, Graham, Commonwealth Scientific and Industrial Research Organization, Australia; Doyle, Briony, Commonwealth Scientific and Industrial Research Organization, Australia; Dunlop, John, Commonwealth Scientific and Industrial Research Organization, Australia; Economou, Dean, Commonwealth Scientific and Industrial Research Organization, Australia; Farmer, Tony, Commonwealth Scientific and Industrial Research Organization, Australia; Farrant, David, Commonwealth Scientific and Industrial Research Organization, Australia; Foley, Cathy, Commonwealth Scientific and Industrial Research Organization, Australia; Fox, Bruce, Commonwealth Scientific and Industrial Research Organization, Australia; July 2002; 25p; In English
Contract(s)/Grant(s): RTOP 706-62-31-01
Report No.(s): NASA/CR-2002-211772; NAs 1.26:211772; TIPP-1516; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The ultimate goal of ageless aerospace vehicles requires the development of materials and structures that are capable of self-assessment and repair. The aim of this project is to develop and examine concepts for intelligent integrated sensing, processing, communication and decision-making systems that could perform the distributed health monitoring functions of a smart vehicle. The purpose of this report is to present a list of the types of threats to which an aerospace vehicle is subject, general strategies for detecting them and/or their consequences, and to identify the quantities that must be measured for implementation of these strategies. Thus, this report establishes in broad terms the requirements that must be satisfied by an integrated vehicle health monitoring system. A number of significant issues are raised and discussed, including the wide range of requirements for the sensing and response system (the quantities that must be measured, and temporal and spatial measurement and response scales), the use of embedded and movable sensors, the need to distinguish structural damage from sensor or system failure, issues of information loss and sensor and system reliability, and the need to adopt an integrated approach to the solution of sensing, processing, communication and decision-making design problems. Whatever the capabilities of future materials for self-repair or regeneration, it is concluded that there will be a need for an integrated vehicle health monitoring system.
Author
*Aerospace Vehicles; Design Analysis; Information Systems; Maintenance; System Failures*

**20020066348** Loyola Coll., Dept. of Electrical Engineering and Engineering Science, Baltimore, MD USA
**Case Study: Using a Neural Network to Identify Flaws During Ultrasonic Testing**
Kayabasi, Alp, Loyola Coll., USA; Kohne, Glenn S., Loyola Coll., USA; Coyne, Paul J., Jr., Loyola Coll., USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 481-494; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

A neural network or more formally an artificial neuronal network involves the implementation, either in hardware or software, of a parallel distributed processing computation structure or neurocomputers that is capable of tasks such as pattern recognition in nondestructive testing, which is the example chosen for this case study. These neurocomputers can function similarly to the human brain, although they are not limited to this function. It is estimated that the human brain is composed of 10(exp 11) neurons; each connected to 10(exp 4) other neurons, which implement a massively parallel computation structure capable of very complex tasks, some still far beyond the capabilities of the today's computers. The neuron is the fundamental processing unit in the brain and in the artificial neuronal network. This case study will focus on the utility of neural networks for the development of a flaw size identifier, which could be used as part of a computer-based classifier of flaws during ultrasonic pulse-echo nondestructive testing. Additionally, the various options available and decisions required in the selection of particular neural network topologies as well as the corresponding training and testing signals will be presented.
Derived from text
*Neural Nets; Neurophysiology; Parallel Processing (Computers); Ultrasonic Tests; Ultrasonic Flaw Detection*

## 39
## STRUCTURAL MECHANICS

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

**20020065293** Corps of Engineers, Washington, DC USA
**Engineering and Design: Nonlinear, Incremental Structural Analysis of Massive Concrete Structures**
Aug. 31, 1994; 76p; In English
Report No.(s): AD-A403503; USACE-ETL-1110-2-365; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This engineer technical letter (ETL) provides guidance for performing a nonlinear, incremental structural analysis (NISA) for massive concrete structures (MCS). This ETL applies to HQUSACE elements, major subordinate commands, districts, laboratories, and field operating activities (FOA) having responsibilities for the design of civil works projects.
DTIC
*Structural Analysis; Concrete Structures*

**20020065309** Corps of Engineers, Washington, DC USA
**Engineering and Design: Structural Evaluation of Welded Aluminum Guardrails on Civil Works Projects**
Barber, Paul D.; Sep. 30, 1994; 13p; In English
Report No.(s): AD-A403365; ETL-1110-2-534; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This engineer technical letter provides guidance for structural evaluation of guardrails on civil works projects.
DTIC
*Safety; Structural Engineering*

**20020065310** Corps of Engineers, Washington, DC USA
**Engineering and Design: Seismic Design for Civil Works Buildings**
Barber, Paul D.; Aug. 31, 1994; 4p; In English
Report No.(s): AD-A403364; ETL-1110-2-366; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The purpose of this engineer technical letter is to ensure that the seismic design guidance followed for new military buildings, and new additions to these buildings, is followed for civil works buildings also.
DTIC
*Seismology; Structural Engineering; Earthquakes; Buildings*

**20020065458** Carnegie Inst. of Tech., Dept. of Civil Engineering, Pittsburgh, PA USA

**The Stress Intensity Factor at the Tip of the Crack as Influenced by Rivet Forces** ***Progress Report***

Romunldi, James P.; Mar. 1959; 29p; In English

Contract(s)/Grant(s): AF49(638)-237

Report No.(s): AD-A403626; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The effect of a riveted stiffener placed perpendicular to and in advance of a crack is twofold: first, the stiffener reduces the buckling of the plate containing the crack and second, rivet forces will be induced such that all rivets in the neighborhood of the crack tip will apply forces to the plate in a direction to oppose further motion of the crack. Both of these effects tend to stop the crack in the vicinity of the stiffener. In this report, experimental data is presented supporting the analytical study made in the previous Status Report. These test show that it is possible to measure K by use of strain-gages placed near the crack tip. Another test involves determination of K(sub c), the critical stress-intensity factor for onset of rapid fracture. Later tests investigate the effect of a single rivet force upon stress at the crack tip. Although the results of these tests are here summarized, this testing program is not complete.

DTIC

*Stress Intensity Factors; Stress Concentration; Strain Gages; Buckling; Fracturing*

**20020065463** Pennsylvania Univ., Dept. of Materials Science and Engineering, Philadelphia, PA USA

**Combined Theoretical and Experimental Study of a New Mechanism of Yielding with Application to the Brittle-Ductile Transition** ***Final Report, 1 Feb. 1998-30 Jun. 2001***

Pope, David P.; Jun. 2001; 9p; In English

Contract(s)/Grant(s): F49620-98-1-0245

Report No.(s): AD-A403571; AFRL-SR-AR-TR-02-0225; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A new strain-rate dependent mechanism of dislocation generation that can become active suddenly above a critical temperature has been developed in our research carried out under the present AFOSR support. This mechanism is a thermally driven, stress-assisted cooperative instability of many dislocation loops that leads to an outburst of dislocation activity above the strain-rate dependent critical temperature. The strain-rate dependence originates from the glide of pre-existing and thermally nucleated dislocations below the critical temperature. We have determined theoretically and shown by experiments that the onset of yielding in a crack-free crystal with a very low dislocation content (Si in our study) is remarkably similar to the brittle-to-ductile transition (BDT) in a pre-cracked crystal of the same material. There is significant evidence to show that both processes are controlled by the cooperative process of dislocation generation. As a result, we now have, for the first time, a model that is capable of predicting the brittle-to-ductile-transition-temperature (BDTT) of a material as a function of strain rate and dislocation content.

DTIC

*Yield; Ductile-Brittle Transition; Crystals; Predictions*

**20020065524** Institute of Industrial Technology TNO, Apeldoorn, Netherlands

**Further Interpretation of Test on Stiffened Panels for Integrity of Marine Ships** ***Final Report Nadere Uitwerking van Proeven op Verstijfde Panelen T. B. V. Integriteit van Marinevaartuigen***

Lont, M. A., Institute of Industrial Technology TNO, Netherlands; Krom, A. H. M., Institute of Industrial Technology TNO, Netherlands; May 06, 2002; 42p; In English; Original contains color illustrations

Contract(s)/Grant(s): A97/KM/144; TNO Proj. 007.20103

Report No.(s): TD-99-0384; MI-99-00949/LON/VIS; Copyright; Avail: Issuing Activity

In the Laboratory of Marine Technology at the Delft University of Technology (TO Delft) four stiffened panels are tested in a 6000 kN horizontal testing machine. In the middle of the stiffened panels a butt weld was present, simulating a welded connection between two plate sections in a ship structure. Along the butt weld a saw cut with a length of 100 mm was made. A fatigue test was performed to a crack length of 1.2 m, half the panel width. After that the panel was cooled to a lower temperature (-20 or 0 C), and a static fracture test was performed. The aim of the test was to measure the influence of the stiffeners on fatigue crack growth along a butt weld and to measure the fracture toughness of normal ship steel plate at a lower service temperature. The conclusions are: (1) The calculation of crack growth with values determined from small specimen is safe (2) The effect of stiffeners is less than expected, especially at variable amplitude testing (3)The fracture test at -20 C showed brittle fracture, but the fracture toughness value K(sub c), appears to be at the same value of ductile material behavior at higher temperature.

Author

*Fatigue Tests; Panels; Metal Fatigue; Ships; Crack Propagation; Fracture Strength; Metal Plates*

**20020065553** Veridian Systems Div., Aerospace Engineering Group, Chantilly, VA USA

**Rapid Modeling and Analysis Tools: Evolution, Status, Needs and Directions, *15 Mar. - 30 Sep. 2001***

Knight, Norman F., Jr., Veridian Systems Div., USA; Stone, Thomas J., Veridian Systems Div., USA; July 2002; 86p; In English; Original contains color illustrations

Contract(s)/Grant(s): NASA Order L-13907; GS-35F-4503G; RTOP 705-30-11-11

Report No.(s): NASA/CR-2002-211751; NAS 1.26:211751; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Advanced aerospace systems are becoming increasingly more complex, and customers are demanding lower cost, higher performance, and high reliability. Increased demands are placed on the design engineers to collaborate and integrate design needs and objectives early in the design process to minimize risks that may occur later in the design development stage. High performance systems require better understanding of system sensitivities much earlier in the design process to meet these goals. The knowledge, skills, intuition, and experience of an individual design engineer will need to be extended significantly for the next generation of aerospace system designs. Then a collaborative effort involving the designer, rapid and reliable analysis tools and virtual experts will result in advanced aerospace systems that are safe, reliable, and efficient. This paper discusses the evolution, status, needs and directions for rapid modeling and analysis tools for structural analysis. First, the evolution of computerized design and analysis tools is briefly described. Next, the status of representative design and analysis tools is described along with a brief statement on their functionality. Then technology advancements to achieve rapid modeling and analysis are identified. Finally, potential future directions including possible prototype configurations are proposed.

Author

*Aerospace Systems; Design Analysis; Structural Analysis; Computer Aided Design*

**20020065563** Department of Energy, Office of Scientific and Technical Information, Oak Ridge, TN USA

**Quantitative Interpretation of X-ray Absorption Near Edge Structure *Progress Report, 15 Sep. 1998 - 14 Sep. 1999***

Bare, S.; Stohr, J.; 1999; 16p; In English

Report No.(s): DE2002-762754; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This work is carried out in collaboration with Dr. Simon Bare of the UOP LLC Research Center. The tools and extensions proposed include the generalization of FEFF for configurational averages, and tools for analyzing XANES including electronic structure such as densities of states, charge transfer, etc. These will be tested by the analyses of a number of materials of particular interest to UOP. Examples include Pt salts and bimetallic clusters, both on alumina. We also proposed studying similar catalysts using in situ XANES combined with FEFF calculations to better elucidate the role of Cl in these modified catalysts.

NTIS

*X Ray Absorption; Catalysts; Electronic Structure; Bimetals; Aluminum Oxides*

**20020066168** Swedish Defence Research Establishment, Aeronautics Div., Stockholm, Sweden

**Stress Intensity Factor Equation for Cracks at an Open Hole in a Sheet of Finite Dimensions Subjected to a Uniform, Uniaxial Stress**

Palmberg, B.; Jun. 2001; 88p; In English

Report No.(s): PB2002-105005; FOI-R-0061-SE; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

In many applications it is more convenient to have an equation for computing the stress intensity factor instead of interpolating in tables or reading values from graphs. This is particularly true if there are many parameters involved as in the case of radial cracks at a circular hole in a rectangular sheet. The aim of this investigation is to develop a stress intensity factor equation for cracks at a hole in a limited sheet. It is assumed that the sheet is loaded along the edges parallel to the cracks with a uniform, uniaxial stress. The aim is also to assess the accuracy of the equation through comparisons to different numerical solutions. An equation consisting of five parts has been developed. The first part is the stress intensity factor for cracks at a hole in an infinite sheet. The second part is a finite width correction. The third part makes a correction for eccentricity. The fourth part represents a finite height correction. Finally, the fifth part includes a correction for interaction between a hole and the finite height. The accuracy of the stress intensity factor equation is generally better than 20% and in most cases better than 8%.

NTIS

*Cracking (Fracturing); Finite Element Method; Stress Analysis; Stress Intensity Factors*

**20020066339** California Univ., Dept. of Chemical Engineering and Materials Science, Davis, CA USA

**The Onset of Tensile Instability**

Meier, Mike, California Univ., USA; Mukherjee, Amiya K., California Univ., USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 361-378; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

In this experiment the plastic deformation behavior and the onset of plastic instability of some common structural alloys is investigated. The usual mechanical properties are measured from stress-strain curves, but in addition, strain hardening behavior and the onset of plastic instability are studied. Much more is happening during a tensile test than is listed in standard materials properties data tables. The goal of this experiment is to investigate these additional phenomena.
Derived from text
*Mechanical Properties; Tensile Tests; Stability; Plastic Deformation; Strain Measurement*

**20020066342** Purdue Univ. Calumet, Dept. of Engineering, Hammond, IN USA
**Load Testing of Temporary Structural Platforms**
Abramowitz, Harvey, Purdue Univ. Calumet, USA; Bennett, Ralph E., III, Purdue Univ. Calumet, USA; Bennett, John, Purdue Univ. Calumet, USA; Hendrickson, Rick J., Purdue Univ. Calumet, USA; Koultourides, Caris, Purdue Univ. Calumet, USA; Tredway, Brandon W., Purdue Univ. Calumet, USA; Kuchariski, Walter, Purdue Univ. Calumet, USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 413-434; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

This paper presents an introduction to the concept of dynamic loading. The topics include: 1) A comparison of static loading and dynamic loading; 2) Demonstration of a method for determining dynamic loading; 3) Comparisons of theoretical and actual static and dynamic loading results; and 4) Dynamic loading criteria recommendations. This paper is presented in viewgraph form.
CASI
*Load Tests; Dynamic Loads; Manufacturing; Structural Engineering*

**20020066347** Idaho Univ., Dept. of Mechanical Engineering, Moscow, ID USA
**The Dynamic Young's Modulus**
Smelser, Ron E., Idaho Univ., USA; Odom, Edwin M., Idaho Univ., USA; Organ, K. V., Idaho Univ., USA; National Educators' Workshop: Update 2001: Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 471-479; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

The elastic modulus of a material is of primary importance in mechanical design. The determination of this modulus for thin rods is quite difficult. Traditional methods using strain gages or extensometers are problematic. Applying strain gages around small diameter rods is difficult. Extensometers can be damaged and can bend the thin rods when mounted on them. The experiment measures the elastic modulus of thin rods using the principles of dynamics. This experiment employs a simple apparatus to determine a fundamental property of engineering materials. The experiment provides a rich ground for introducing and discussing the difference between mass moments of inertia and area sectional properties. The analysis of the experiment also offers an opportunity to explain engineering approximations and how to validate the approximations.
Derived from text
*Mechanical Engineering; Measuring Instruments; Dynamic Modulus of Elasticity; Mechanical Oscillators*

**20020066449** Corps of Engineers, Washington, DC USA
**Engineering and Design: Nonlinear Incremental Structural Analysis of Zintel Canyon Dam**
Barber, Paul D.; Dec. 31, 1994; 68p; In English
Report No.(s): AD-A403366; ETL-1110-2-536; No Copyright; Avail: CASI; A04, Hardcopy

This engineer technical letter provides an example of the use of nonlinear incremental structural analysis (NISA) for a massive concrete structure (MCS).
DTIC
*Structural Analysis; Dams; Nonlinearity; Concrete Structures*

**20020066481** Alpha STAR Corp., Long Beach, CA USA
**Age and Stress Prediction**
Spinoff 2000; 2000, pp. 60-61; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

Genoa is a software product that predicts progressive aging and failure in a variety of materials. It is the result of a SBIR contract between the Glenn Research Center and Alpha Star Corporation. Genoa allows designers to determine if the materials they plan on applying to a structure are up to the task or if alternate materials should be considered. Genoa's two feature applications are its progressive failure simulations and its test verification. It allows for a reduction in inspection frequency, rapid

design solutions, and manufacturing with low cost materials. It will benefit the aerospace, airline, and automotive industries, with future applications for other uses.
Author
*Technology Utilization; Failure Analysis; Aging (Materials); Stress Analysis; Structural Analysis; Predictions; Applications Programs (Computers)*

**20020066511** Mississippi State Univ., Dept. of Aerospace Engineering, Mississippi State, MS USA
**Reliability Analysis and Reliability-Based Design Optimization of Circular Composite Cylinders Under Axial Compression, *May 2000 - May 2001***
Rais-Rohani, Masoud, Mississippi State Univ., USA; [2001]; 18p; In English
Contract(s)/Grant(s): NAG1-2038; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This report describes the preliminary results of an investigation on component reliability analysis and reliability-based design optimization of thin-walled circular composite cylinders with average diameter and average length of 15 inches. Structural reliability is based on axial buckling strength of the cylinder. Both Monte Carlo simulation and First Order Reliability Method are considered for reliability analysis with the latter incorporated into the reliability-based structural optimization problem. to improve the efficiency of reliability sensitivity analysis and design optimization solution, the buckling strength of the cylinder is estimated using a second-order response surface model. The sensitivity of the reliability index with respect to the mean and standard deviation of each random variable is calculated and compared. The reliability index is found to be extremely sensitive to the applied load and elastic modulus of the material in the fiber direction. The cylinder diameter was found to have the third highest impact on the reliability index. Also the uncertainty in the applied load, captured by examining different values for its coefficient of variation, is found to have a large influence on cylinder reliability. The optimization problem for minimum weight is solved subject to a design constraint on element reliability index. The methodology, solution procedure and optimization results are included in this report.
Author
*Circular Cylinders; Structural Reliability; Reliability Analysis; Design Optimization; Axial Compression Loads; Structural Analysis*

**20020066585** NASA Marshall Space Flight Center, Huntsville, AL USA
**MSFC/Ball Space-Act Test Results of SBMD**
Hadaway, James, Alabama Univ., USA; Brown, Bob, Ball Aerospace Systems Div., USA; Eng, Ron, NASA Marshall Space Flight Center, USA; Stahl, Phil, NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 2nd Annual Technology Days, 22-24 May 2002, Huntsville, AL, USA
Contract(s)/Grant(s): NCC2-800; No Copyright; Avail: Issuing Activity; Abstract Only
The results of two cryo tests of the SBMD that were funded by Ball Aerospace through a Space-Act Agreement with MSFC will be discussed. These tests followed the formal completion of the SBMD program. The PhaseCam interferometer, rather than the Wavescope Shack-Hartmann sensor, was used during these tests.
Author
*Cryogenics; Aerospace Systems; Sensors; Performance Tests*

**20020066586** NASA Marshall Space Flight Center, Huntsville, AL USA
**AMSD Reaction Structure Cryo Deformation Test Plan**
Eng, Ron, NASA Marshall Space Flight Center, USA; Hraba, John, NASA Marshall Space Flight Center, USA; Thornton, Gary, NASA Marshall Space Flight Center, USA; Baker, Mark, NASA Marshall Space Flight Center, USA; Haight, Harlan, NASA Marshall Space Flight Center, USA; Hadaway, James, Alabama Univ., USA; Blackwell, Lisa, Alabama Univ., USA; [2002]; 1p; In English; 2nd Annual Technology Days, 22-24 May 2002, Huntsville, AL, USA
Contract(s)/Grant(s): NCC8-200; No Copyright; Avail: Issuing Activity; Abstract Only
The method developed for measuring both in-plane & out-of-plane cryo deformations of AMSD reaction structures at the XRCF will be presented. For in-plane measurements, a theodolite is used to track the positions of several (up to ten) targets on the reaction structure. For out-of-plane measurements, the Leica ADM is used to measure the change in distance to several (up to ten) corner cubes attached to the reaction structure.
Author
*Cryogenics; Deformation; Reaction Kinetics*

**20020066603** Prins Maurits Lab. TNO, Rijswijk, Netherlands

**40 Tonne Donor/Acceptor Trial: Damage Assessment of Domestic Houses** ***Final Report 40 ton Donor/Acceptor Explosieproef: Evaluatie van de Schade aan de Woonhuizen***

vanDoormaal, J. C. A. M., Prins Maurits Lab. TNO, Netherlands; May 2002; 59p; In English; Original contains color illustrations

Contract(s)/Grant(s): A97/KL/443; TNO Proj. 014.11915

Report No.(s): TD2002-0013; PMO-2002-A13; Copyright; Avail: Issuing Activity

TNO-Prins Maurits Laboratory has participated in a UK-Australian full scale explosion trial with the purpose of validating the current safety distances for inhabited buildings and public roads around ammunition storage sites. On 27 september 1999, 462 MK 82 GP (general purpose) bombs (in total equivalent to 40 tons of TNT (trinitrotoluene)), stored in a Standard ammunition storehouse, were simultaneously exploded at the Woomera test site in South Australia. At several distances around the storehouse target structures were built, e.g. six English brick domestic houses, a typical Norwegian wooden house, a US observation post, trenches and various cars. In the Dutch sector typical Out-of-Area structures, such as mobile sleeping accommodations were placed. In this report the damage to the masonry domestic houses is described. The loading on these houses was measured and vulnerable parts were identified. It was concluded that an IBD (Inhabited Building Distance) of 759 m for 40 tons of NEQ explosives is verified by the trial as far as the side-on overpressure and type of damage are concerned. With respect to the number of lethal fragments, a slightly smaller IBD (of about 700 m) be allowed in case of barricades around the donor. For nonbarricaded directions the IBD should be slightly larger (of about 790 m) than based on blast. In conclusion, the 'old' guidelines given in AASTP-1, based on WO-II data, are still applicable for typical structures from the end of the twentieth century. Extra attention, however, should be given to the windows, since glass fragments may even at IBD and larger distances lead to lethality.

Author

*Buildings; Explosions; Safety; Explosives; Storage; Destructive Tests; Damage Assessment*

**20020067395** NASA Marshall Space Flight Center, Huntsville, AL USA

**Experimental Observations of Localization Phenomena in Sands: Plane Strain Versus Triaxial Compression Conditions**

Alshibli, Khalid A., Louisiana State Univ., USA; Batiste, Susan N., Colorado Univ., USA; Sture, Stein, Colorado Univ., USA; [2002]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

A comprehensive experimental investigation was conducted to investigate the effects of loading condition and confining pressure on strength properties and instability phenomena in sands. A uniform sub-rounded to rounded natural silica sand known as F-75 Ottawa sand was used in the investigation. The results of a series on Conventional Triaxial Compression (CTC) experiments tested under very low confining pressures (0.05 - 1.30) kPa tested in a Microgravity environment abroad the NASA Space Shuttle are presented in addition to the results similar specimens tested in terrestrial laboratory to investigate the effect of confining pressure on the constitutive behavior of sands. The behavior of the CTC experiments is compared with the results of Plane Strain (PS) experiments. Computed tomography and other digital imaging techniques were used to study the development and evolution of shear bands.

Author

*Plane Strain; Imaging Techniques; Pressure Effects; Sands; Microgravity*

**20020067413** Arkansas Technical Univ., Dept. of Mechanical Engineering, Russellville, AR USA

**Development of a Generic Creep-Fatigue Life Prediction Model**

Goswami, Tarun, Arkansas Technical Univ., USA; [2002]; 4p; In English

Contract(s)/Grant(s): NAG3-2798; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The objective of this research proposal is to further compile creep-fatigue data of steel alloys and superalloys used in military aircraft engines and/or rocket engines and to develop a statistical multivariate equation. The newly derived model will be a probabilistic fit to all the data compiled from various sources. Attempts will be made to procure the creep-fatigue data from NASA Glenn Research Center and other sources to further develop life prediction models for specific alloy groups. In a previous effort [1-3], a bank of creep-fatigue data has been compiled and tabulated under a range of known test parameters. These test parameters are called independent variables, namely; total strain range, strain rate, hold time, and temperature. The present research attempts to use these variables to develop a multivariate equation, which will be a probabilistic equation fitting a large database. The data predicted by the new model will be analyzed using the normal distribution fits, the closer the predicted lives are with the experimental lives (normal line 1 to 1 fit) the better the prediction. This will be evaluated in terms of a coefficient of correlation, R 2 as well. A multivariate equation developed earlier [3] has the following form, where S, R, T, and H have specific meaning discussed later.

Derived from text
*Creep Properties; Fatigue (Materials); Prediction Analysis Techniques; Life (Durability); Multivariate Statistical Analysis; Steels; Heat Resistant Alloys; Aircraft Engines*

## 42
## GEOSCIENCES (GENERAL)

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

**20020065277** Geological Survey, Water Resources Div., Little Rock, AR USA
**Water Resources Data for Arkansas, Water Year 2001** ***Annual Report, (Annual) 1 Oct. 00 - 30 Sep. 01***
Porter, J. E.; Evans, D. A.; Remsing, L. M.; 2002; 412p
Report No.(s): PB2002-107286; USGS/WDR/AR-01-1; No Copyright; Avail: CASI; A18, Hardcopy; A04, Microfiche
The Water Resources Division of the U.S. Geological Survey, in cooperation with State, Federal, and other local governmental agencies, obtains a large amount of data pertaining to the water resources of Arkansas each year. These data, accumulated during many water years, constitute a valuable data base for developing an improved understanding of the water resources of the State. Water resources data reported for the 2001 water year for Arkansas consist of records of discharge and water quality (physical measurements and chemical concentrations) of streams, water quality of lakes and ground-water levels and ground-water quality. Data from selected sites in Missouri and Oklahoma also are included. This report contains daily discharge records for 89 surface-water gaging stations, water-quality data for 70 surface-water stations and 5 wells, and water levels for 13 observation wells. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements.
NTIS
*Arkansas; Surface Water; Ground Water; Water Resources; Data Acquisition; Tables (Data); Hydrology; Geological Surveys*

**20020065278** Geological Survey, Water Resources Div., Iowa City, IA USA
**Water Resources Data for Iowa, Water Year 2001, Volume 1, Surface Water-Mississippi River Basin** ***Annual Report, 1 Oct. 00 - 30 Sep. 01***
Nalley, G. M.; Gorman, J. G.; Goodrich, R. D.; Miller, V. E.; Turco, M. J.; 2002; 406p; In English; See also PB2002-107283, Volume 2
Report No.(s): PB2002-107285; USGS/WDR/IA-01-1; No Copyright; Avail: CASI; A18, Hardcopy; A04, Microfiche
Water resources data for Iowa for the 2001 water year consists of records of stage, discharge, and water quality of streams; stage, and/or contents of lakes and reservoirs; ground water levels and water quality of ground-water wells. This report volume contains discharge records for 94 gaging stations; stage or contents for 6 lakes and reservoirs and 7 streams; water quality for 1 stream-gaging station; sediment records for 11 stream-gaging stations; and precipitation record for 7 precipitation stations. Also included are data for 58 crest-stage partial record stations.
NTIS
*Data Acquisition; Tables (Data); Hydrology; Surface Water; Ground Water*

**20020065297** Corps of Engineers, Washington, DC USA
**Engineering and Design: Rock Mass Classification Data Requirements for Rippability**
McCormick, William N., Jr; Jun. 30, 1983; 9p; In English
Report No.(s): AD-A403536; USACE-ETL-1110-2-282; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
no abstract.
Author
*Excavation; Rocks*

**20020066132** Geological Survey, Denver, CO USA
**Water-Table Fluctuations in the Amargosa Desert, Nye County, Nevada**
Whelan, J. F.; Paces, J. B.; 1999; 10p; In English
Report No.(s): DE2002-794104; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Pleistocene ground-water discharge deposits approximately 20 km southwest of Yucca Mountain were previously thought to represent pluvial water-table rises of 80 to 120 m. Data from new boreholes at two of the three discharge sites indicate that the

modern water-table is at depths of only 17 to 30 m and that this shallow water is part of the regional ground-water flow system rather than being perched. Calcite in equilibrium with this modern ground water would have isotopic compositions similar to those in Pleistocene calcite associated with the discharge deposits. Carbon and uranium isotopes in both ground water and discharge deposits imply that past discharge consisted of a mixture of both shallow and deep ground water. These data limit Pleistocene water-table fluctuations at the specified Amargosa Desert discharge sites to between 17 and 30 m and eliminate the need to invoke large water-table rises.
NTIS
*Water Tables; Ground Water; Boreholes; Calcite; Carbon Isotopes; Uranium Isotopes; Pleistocene Epoch*

**20020066188** Rocky Mountain Oilfield Testing Center, Casper, WY USA
**Evaluation of Subsurface Flow and Free-water Surface Wetlands Treating NPR-3 Produced Water-Year No. 1** ***Progress Report***
Oct. 13, 2001; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-794470; DOE/RMOTC-020144; No Copyright; Avail: National Technical Information Service (NTIS)
This paper is a summary of some of the activities conducted during the first year of a three-year cooperative research and development agreement (CRADA) between the Department of Energy (DOE) Rocky Mountain Oilfield Testing Center (RMOTC) and Texaco relating to the treatment of produced water by constructed wetlands. The first year of the CRADA is for design, construction and acclimation of the wetland pilot units. The second and third years of the CRADA are for tracking performance of pilot wetlands as the plant and microbial communities mature. A treatment wetland is a proven technology for the secondary and tertiary treatment of produced water, storm water and other wastewaters. Treatment wetlands are typically classified as either free-water surface (FWS) or subsurface flow (SSF). Both FWS and SSF wetlands work well when properly designed and operated. This paper presents a collection of kinetic data gathered from pilot units fed a slipstream of Wyoming (NPR-3) produced water. The pilot units are set up outdoors to test climatic influences on treatment. Monitoring parameters include evapotranspiration, plant growth, temperature, and NPDES discharge limits. The pilot wetlands (FWS and SSF) consist of a series of 100-gal plastic tubs filled with local soils, gravel, sharp sand and native wetland plants (cattail (Typha spp.), bulrush (Scirpus spp.), dwarf spikerush (Eleocharis)). Feed pumps control hydraulic retention time (HRT) and simple water control structures control the depth of water. The treated water is returned to the existing produced water treatment system. All NPDES discharge limits are met. Observations are included on training RMOTC summer students to do environmental work.
NTIS
*Wetlands; Hydrology; Ground Water; Water Flow*

**20020066189** Department of Energy, Idaho Falls, ID USA
**Annual INTEC Groundwater Monitoring Report for Group 5: Snake River Plain Aquifer (2001)**
Feb. 2001; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-794383; DOE/ID-10930; No Copyright; Avail: National Technical Information Service (NTIS)
This report describes the monitoring activities conducted and presents the results of groundwater sampling and water-level measurements from October 2000 to September 2001. Groundwater samples were initially collected from 41 wells from the Idaho Nuclear Technology and Engineering Center and the Central Facilities Area (CFA) and analyzed for iodine-129, strontium-90, tritium, gross alpha, gross beta, technetium-99, uranium isotopes, plutonium isotopes, neptunium-237, gamma spectrometry, and mercury. Samples from 41 wells were collected in April and May 2001. Additional sampling was conducted in August 2001 and included in two CFA production wells, the CFA point of compliance for the production wells, one well was previously sampled and five additional monitoring wells. Water-level measurements were taken from in the Idaho Nuclear Technology and Engineering Center, Central Facilities Area, and the area south of Central Facilities Area to evaluate groundwater flow directions. Water-level measurements indicated groundwater flow to the south-southwest from the Idaho Nuclear Technology and Engineering Center.
NTIS
*Ground Water; Aquifers; Rivers; Water Depth*

**20020066196** National Park Service, Water Resources Div., Fort Collins, CO USA
**Baseline Water Quality Data Inventory and Analysis: Chickamauga and Chattanooga National Military Park, Volume 1**
Oct. 2001; 524p; In English
Report No.(s): PB2002-106348; NPS/NPRWRD/NRTR-99/254-Vol-1; No Copyright; Avail: CASI; A22, Hardcopy; A04, Microfiche

This document presents the results of surface water quality data retrievals for Chickamauga and Chattanooga National Military Park (CHCH) from six of the USA Environmental Protection Agency's (EPA) national databases: (1) Storage and Retrieval (STORET) water quality database management system; (2) River Reach File (RF3); (3) Industrial Facilities Discharge (IFD); (4) Drinking Water Supplies (DRINKS); (5) Water Gages (GAGES); and (6) Water Impoundments (DAMS). This document is one product resulting from a cooperative contractual endeavor between the National Park Service's (NPS) Servicewide Inventory and Monitoring Program, the National Park Service's Water Resources Division (WRD), and Horizon Systems Corporation to retrieve, format, and analyze surface water quality data for all units of the National Park System containing significant water resources. The primary goal of the project is to provide descriptive water quality information in a manner and format that is both consistent with the goals of the Servicewide Inventory and Monitoring Program and usable by park resource managers. The document provides: (1) a complete inventory of all retrieved water quality parameter data, water quality stations, and the entities responsible for the data collection; (2) descriptive statistics and appropriate graphical plots of water quality data characterizing period of record, annual, and seasonal central tendencies and trends; (3) a comparison of the park's water quality data to relevant EPA and WRD water quality screening criteria; and (4) an Inventory Data Evaluation and Analysis (IDEA) to determine what Servicewide Inventory and Monitoring Program 'Level 1' water quality parameters have been measured within the study area. Accompanying the report are disks containing digital copies of all data used in the report, as well as all components of the report (tables, figures. etc.).
NTIS
*Water Pollution; Surface Water; Water Quality; Water Sampling*

**20020066199** Geological Survey, Water Resources Div., Lawrence, KS USA
**Water Resources Data for Kansas, Water Year 2001** ***Annual Report, 1 Oct. 2000 - 30 Sep. 2001***
Putnam, J. E.; Lacock, D. L.; Schneider, D. R.; Mar. 2002; 554p; In English
Report No.(s): PB2002-106681; USGS/WDR/KS-01-1; No Copyright; Avail: CASI; A24, Hardcopy; A04, Microfiche
Water resources data for the 2001 water year for Kansas consist of records of stage, discharge, and water quality of streams; elevation and contents of lakes and reservoirs; and water levels of ground-water wells. This report contains records for water discharge at 145 complete-record gaging stations; elevation and contents at 20 lakes and reservoirs; water-quality records at two precipitation stations, water-level data at 19 observation wells; and records of specific conductance, pH, water temperature, dissolved oxygen, and turbidity at 11 gaging stations. Also included are discharge data for 26 high-flow partial-record stations, miscellaneous onsite water-quality data collected at 140 stations, and suspended-sediment concentration for 12 stations. These data represent that part of the National Water Information System collected by the U.S. Geological Survey in cooperation with local, State, and Federal agencies in Kansas.
NTIS
*Kansas; Surface Water; Ground Water; Hydrology; Water Resources*

**20020066200** Geological Survey, Water Resources Div., Raleigh, NC USA
**Water Resources Data for North Carolina, Water Year 2001, Volume 1A, Surface-Water Records** ***Annual Report, 1 Oct. 2000 - 30 Sep. 2001***
Ragland, B. C.; Walters, D. A.; Cartano, G. D.; Taylor, J. E.; Mar. 2002; 642p; In English
Report No.(s): PB2002-106380; USGS/WDR/NC-01-1A; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche
Water-resources data for the 2001 water year for North Carolina consists of discharge records for 209 gaging stations; stage only records for 52 gaging stations; stage and contents for 62 lakes and reservoirs; water quality for 101 gaging and 91 miscellaneous sites; continuous daily tide stage at four sites and continuous precipitation at 98 sites. Additional water data were collected at 84 sites not involved in the systematic data-collection program, and are published as miscellaneous measurements. Data contained in this volume includes discharge records for 63 gaging stations; stage and contents for 17 lakes and reservoirs; stage for 45 gaging stations; water quality for 72 gaging stations and 91 miscellaneous sites; continuous daily tide stage at four sites; continuous precipitation at six sites and miscellaneous measurements for eight stations not involved in the systematic data-collection program. The collection of water-resources data in North Carolina is part of the National Water-Data System operated by the U.S. Geological Survey in cooperation with state, municipal, and Federal agencies.
NTIS
*North Carolina; Hydrology; Surface Water; Ground Water; Water Resources*

**20020066201** Geological Survey, Water Resources Div., Tacoma, WA USA

**Evapotranspiration from Selected Fallowed Agricultural Fields on the Tule Lake National Wildlife Refuge, California, during May to October 2000** ***Final Report***

Bidlake, W. R.; 2002; In English

Report No.(s): PB2002-107591; USGS-WRI-02-4055; No Copyright; Avail: National Technical Information Service (NTIS)

An investigation of evapotranspiration, vegetation quantity and composition, and depth to the water table below the land surface was made at three sites in two fallowed agricultural lots on the 15,800-hectare Tule Lake National Wildlife Refuge in northern California during the 2000 growing season.

NTIS

*Evapotranspiration; Water Tables; California*

**20020066298** Geological Survey, Water Resources Div., Tallahassee, FL USA

**Evapotranspiration from a Cypress and Pine Forest Subjected to Natural Fires in Volusia County, Florida, 1998-99** ***Final Report***

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

Report No.(s): PB2002-107167; USGS-WRI-01-4245; No Copyright; Avail: National Technical Information Service (NTIS)

This report presents daily estimates of evapotranspiration during a 2-year period from a forested watershed (Tiger Bay, Volusia County, Fla.), which was subjected to natural fires, and provides evaluations of the causal relations between the environment and evapotranspiration. Measurements were made on a nearly continuous basis from January 1998 through December 1999 at an evapotranspiration station just outside the watershed, using eddy correlation and meteorological instrumentation. An evapotranspiration model based on the Priestley-Taylor equation was used to estimate evapotranspiration for burned and unburned areas and to quantify the relation between evapotranspiration and the environment. A water budget of the watershed was constructed to assess the validity of the eddy correlation-measured evapotranspiration totals for the 2-year period.

NTIS

*Watersheds; Evapotranspiration; Forest Fires; Meteorological Instruments; Estimates*

**20020066299** Geological Survey, Water Resources Div., Menlo Park, CA USA

**Report of Hydrologic Investigations in the Three Sisters Area of Central Oregon, Summer 2001**

Evans, W. C.; Mariner, R. H.; Ingebritsen, S. E.; Kennedy, B. M.; van Soest, M. C.; 2002; In English

Report No.(s): PB2002-107168; USGS/WRI-02/4061; No Copyright; Avail: National Technical Information Service (NTIS)

Uplift in the Three Sisters area was first detected by Wicks and others (2001) using InSAR imagery. That imagery reveals uplift over a broad circular region, with maximum rise at the center reaching 4-5 cm/yr. The uplift is centered several km west of the Cascades crest, at a location lacking young volcanic vents. However, discharge of thermal fluid in this area was recognized a decade prior to the onset of uplift on the basis of a CL- anomaly in Separation Creek, which drains the western flanks of South Sister. In response to the detection of crustal uplift, USGS scientists conducted an investigation of springs and streams in the Separation Creek drainage, which includes the area of maximum uplift, from 8 to 16 July 2001. The main goal of the work was to check the water for geochemical anomalies that would reflect enhanced up-flow of either thermal water or magmatic gases, two processes that might accompany intrusion, especially at the shallow depth of 6-7 km proposed by Wicks and others (2001; 2002). This study was carried out in collaboration with noble-gas experts from the Lawrence Berkeley National Laboratory (LBNL).

NTIS

*Anomalies; Volcanoes; Hydrology; Data Acquisition*

**20020066399** Vermont Univ., Burlington, VT USA

**Least-Cost Groundwater Remediation Using Uncertain Hydrogeological Information** ***Final Report, 15 Sep. 1997 - 14 Sep. 2001***

Pinder, G. F.; Ricciardi, K.; Karatzas, G. P.; Wobber, F.; Roesler, G.; Nov. 28, 2001; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-792700; No Copyright; Avail: National Technical Information Service (NTIS)

The design of groundwater remediation pump-and-treat well networks under aquifer parameter measurement uncertainty can be addressed using an optimal-design strategy based upon the concept of robust optimization. The robust-optimization approach allows for the admission of design alternatives that do not satisfy all design constraints. However in the selection process the algorithm penalizes such selections based upon the number of constraints violated. The result is a design which balances the

importance of reliability with overall project cost. The robust-optimization method has been applied to the problem of groundwater plume containment and risk-based groundwater remediation design. Designs dedicated to groundwater-plume containment assure that the contaminant plume will not extend beyond a prespecified perimeter. Inwardly directed groundwater velocity must be achieved along this perimeter. The outer-approximation optimization technique in combination with a groundwater flow model (PTC) is used to solve this optimal-design problem.
NTIS
*Algorithms; Contaminants; Hydrology Models; Ground Water; Design Analysis*

**20020066405** California Univ., Santa Barbara, CA USA
**Paleoclimate and Glaciological Reconstruction in Central Asia through the Collection and Analysis of Ice Cores and Instrumental Data from the Tien Shan** ***Final Report, 27 Mar. 00 - 26 Mar. 01***
Aizen, V.; Bren, D.; Kreutz, K.; Wake, C.; May 30, 2001; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-793582; No Copyright; Avail: National Technical Information Service (NTIS)
While the majority of ice core investigations have been undertaken in the polar regions, a few ice cores recovered from carefully selected high altitude/mid-to-low latitude glaciers have also provided valuable records of climate variability in these regions. A regional array of high resolution, multi-parameter ice core records developed from temperate and tropical regions of the globe can be used to document regional climate and environmental change in the latitudes which are home to the vast majority of the Earth's human population. In addition, these records can be directly compared with ice core records available from the polar regions and can therefore expand our understanding of inter-hemispheric dynamics of past climate changes. The main objectives of our paleoclimate research in the Tien Shan mountains of middle Asia combine the development of detailed paleoenvironmental records via the physical and chemical analysis of ice cores with the analysis of modern meteorological and hydrological data. The first step in this research, work that was funded jointly by DOE (this grant) and the National Science Foundation - Paleoclimate Program, was the collection of ice cores from the accumulation zone of the Inylchek Glacier and the collection of meteorological data from a variety of stations throughout the Tien Shan. The research effort described in this report was part of a collaborative effort with the USA Geological Survey's (USGS) Global Environmental Research Program which began studying radionuclide deposition in mid-latitude glaciers in 1995.
NTIS
*Glaciers; Geological Surveys; Chemical Analysis; Ice; Data Acquisition*

**20020066420** Stanford Univ., Stanford, CA USA
**Experimental and Analytical Study of Multidimensional Imbibition in Fractured Porous Media**
RangelGerman, E. R.; Kovscek, A. R.; May 2002; 44p; In English
Report No.(s): DE2002-793652; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Using an X-ray computerized tomography (CT) scanner, and a novel, CT-compatible core holder, performed a series of experiments to study air and oil expulsion from rock samples by capillary imbibition of water in a three-dimensional geometry. The air-water system was useful in that a relatively large number of experiments can be conducted to delineate physical processes. Different injection rates and fracture apertures were utilized. Two different fracture flow regimes were identified. The 'filling-fracture' regime shows a plane source that grows in length due to relatively slow water flow through fractures. In the second, 'instantly-filled fracture' regime, the time to fill the fracture is much less than the imbibition time. Here, imbibition performance scales as the square root of time. In the former regime, the mass of water imbibed scales linearly with time.
NTIS
*Porous Materials; Computer Aided Tomography*

**20020066423** Bureau of Reclamation, Technical Service Center, Denver, CO USA
**Tucson Area Water Reclamation and Reuse Study (Regional Effluent Planning Partnership). Progress Report 1977 to 2001** ***Progress Report, 1977-2001***
Dec. 2001; 188p; In English
Report No.(s): PB2002-104724; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche
This report summarizes the progress of the Regional Effluent Planning Partnership (REPP) in developing and facilitating implementation of a coordinated regional long-range plan for effluent use within the Tucson Active Management Team (TAMA). This study has progressed to focusing on one of the original goals-identifying and implementing specific reuse projects.
NTIS
*Effluents; Regional Planning; Water Reclamation; Arizona*

**20020066424** Geological Survey, Water Resources Div., Hartford, CT USA

**Water Quality and Streamflow in SASco Brook Watershed, Southwestern Connecticut, 1994-98** ***Final Report, 1994-1998***

Morrison, J.; 2002; 40p; In English

Report No.(s): PB2002-105104; USGS-WRI-02-4002; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Water quality was characterized at two sites in SASco Brook watershed from 1994 to 1998 to monitor the effects of nonpoint-source contamination from activities in the watershed. Routine water samples were collected monthly at Hulls Farms Road and Route 1; analyzed for concentrations of nutrients (nitrogen, phosphorus, and organic carbon), fecal indicator bacteria, trace elements, and major ions; and measured for basic field parameters. Results of the analyses indicate that concentrations of enterococcus bacteria generally exceeded the Connecticut water-quality standard for contact recreation waters from May through October. Concentrations of nitrogen and phosphorus were elevated at both stations, although trace element concentrations did not reach levels of concern at either station. In addition to monthly sampling, samples were collected at the Hulls Farm Road station during seven storms. In general, concentrations of total nitrogen remained fairly constant during each storm, whereas concentrations of its species-dissolved nitrate and nitrite and total Kjeldahl nitrogen-varied throughout the storms.

NTIS

*Connecticut; Water Quality; Watersheds; Storms; Streams*

**20020066425** Geological Survey, Water Resources Div., Trenton, NJ USA

**Effects of Pumping on Ground-Water Flow near Water-Supply Wells in the Lower Potomac-Raritan-Magothy Aquifer, Pennsauken Township, Camden County, New Jersey** ***Final Report***

Walker, R. L.; 2001; 20p; In English

Report No.(s): PB2002-105102; USGS-WRI-00-4012; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Since the 1970's, hexavalent chromium has been detected in concentrations as great as 1.0 milligram per liter in wells at the Puckach well field operated by the Camden City Department of Utilities, Water Division (Water Department), forcing the Water Department to progressively remove five of its six wells from service between 1975 and 1988. The wells in the Puchack well field range in depth from 140 to 220 feet and are screened in the Lower Potomac-Raritan-Magothy aquifer. The Water Department has continued to pump Puchack Well 1 to maintain a hydraulic gradient toward the well field in an attempt to limit contaminant migration. In late 1997, concerns about treating the water withdrawn from Puchack Well 1 led water managers to consider temporarily discontinuing the pumping. In the spring of 1998, the U.S. Geological Survey (USGS), in cooperation with the New Jersey Department of Environmental Protection, began a preliminary assessment of the potential effects of temporarily removing Puchack Well 1 from service. Water levels in the Lower Potomac-Raritan-Magothy aquifer were measured during both pumping and non-pumping conditions to determine the direction and velocity of ground-water flow and the results were compared.

NTIS

*Aquifers; Geological Surveys; Ground Water; New Jersey; Wells*

**20020066426** Geological Survey, Water Resources Div., Middleton, WI USA

**Simulation of Fish, Mud, and Crystal Lakes and the Shallow Ground-Water System, Dane County, Wisconsin** ***Final Report***

Krohelski, J. T.; Lin, Y. F.; Rose, W. J.; Hunt, R. J.; 2002; 28p; In English

Report No.(s): PB2002-105101; USGS-WRI-02-4014; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report describes the hydrology of Fish and Crystal Lakes (fig. 1) through the development and calibration of a ground-water-flow model. The model simulates lake stage using estimated hydrologic-budget components and hydraulic parameters. The calibrated model is used to simulate the effect of pumping water from Fish Lake on future lake stages. Most data needed for this study were available from a previous, unpublished USGS study of Fish Lake or from USGS hydrologic databases. A 1-year (November 1990-October 1991) water-budget and phosphorus-loading study provided information for estimating surface-runoff coefficients. Historical streamflow records for Black Earth Creek provided the basis for estimating ground-water recharge. Stage records for Fish Lake were available for most of the period since 1966 to present. Data collected specifically for this study were recent (1999 to 2001) stage data and a bathymetric survey to define the morphometry of Crystal Lake.

NTIS

*Geological Surveys; Ground Water; Hydrology Models; Lakes; Shallow Water; Wisconsin; Simulation; Fishes*

**20020066427** Geological Survey, Water Resources Div., Albuquerque, NM USA

**Analysis of the Magnitude and Frequency of the 4-Day Annual low Flow and Regression Equations for Estimating the 4-Day, 3-Year Low-Flow Frequency at Ungaged Sites on Unregulated Streams in New Mexico** ***Final Report***

Waltemeyer, S. D.; 2002; 22p; In English

Report No.(s): PB2002-105099; USGS-WRI-02-4271; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Two regression equations were developed for estimating the 4-day, 3-year (4Q3) low-flow frequency at ungaged sites on unregulated streams in New Mexico. The first, a statewide equation for estimating the 4Q3 low-flow frequency from drainage area and average basin mean winter precipitation, was developed from the data for 50 streamflow-gaging stations that had non-zero 4Q3 low-flow frequency. The 4Q3 low-flow frequency for the 50 gaging stations ranged from 0.08 to 18.7 cubic feet per second. For this state equation, the average standard error of estimate was 126 percent and the coefficient of determination was 0.48. The second, an equation for estimating the 4Q3 low-flow frequency in mountainous regions from drainage area, average basin mean winter precipitation, and average basin slope, was developed from the data for 40 gaging stations located above 7,500 feet in elevation. For this regression equation, the average standard error of estimate was 94 percent and the coefficient of determination was 0.66.

NTIS

*Low Frequencies; New Mexico; Streams; Regression Analysis*

**20020066434** Agri ImaGIS, Maddock, ND USA

**Earth Science GOES E-Commerce**

Spinoff 2000; 2000, pp. 54; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

Software packages commercially marketed by Agri ImaGIS allow customers to analyze farm fields. Agri ImaGIS provides satellite images of farmland and agricultural views to US clients. The company approached NASA-MSU TechLink for access to technology that would improve the company's capabilities to deliver satellite images over the Internet. TechLink found that software with the desired functions had already been developed through NASA's Remote Sensing Database Program. Agri ImaGIS formed a partnership with the University of Minnesota group that allows the company to further develop the software to meet its Internet commerce needs.

Author

*Technology Utilization; Electronic Commerce; Satellite Imagery; Farmlands; Remote Sensing; Internets*

**20020066464** Geological Survey, Water Resources Div., Lawrence, KS USA

**Historical Contributions of Phosphorus from Natural and Agricultural Sources and Implications for Stream Water Quality, Cheney Reservoir Watershed, South-Central Kansas** ***Final Report***

Pope, L. M.; Milligan, C. R.; Mau, D. P.; 2002; 36p; In English

Report No.(s): PB2002-105100; USGS-02-4021; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An examination of soil cores collected from 43 nonagricultural coring sites in the Cheney Reservoir watershed of south-central Kansas was conducted by the U.S. Geological Survey in September 1999. The cores were collected as part of an ongoing cooperative study with the city of Wichita, Kansas. The 43 sites (mostly cemeteries) were thought to have total phosphorus concentrations in the soil that are representative of natural conditions (unaffected by human activity). The purpose of this report is to present the analysis and evaluation of these soil cores, to quantify the phosphorus contributions to Cheney Reservoir from natural and agricultural sources, and to provide estimates of stream-water-quality response to natural concentrations of total phosphorus in the soil.

NTIS

*Agriculture; Geological Surveys; Phosphorus; Reservoirs; Water Quality; Streams; Kansas*

**20020066489** Environmental Protection Agency, Office of Water, Washington, DC USA

**AQUATOX-A Modular Fate and Effects Model for Aquatic Ecosystems-Release 1.1, Volume 2, Technical Documentation (Addendum)**

Nov. 2001; In English

Report No.(s): PB2002-105391; EPA/823/R-01/007; No Copyright; Avail: National Technical Information Service (NTIS)

Since its first release by EPA in September 2000, there have been several changes made to AQUATOX, most significantly those that have improve the simulation of periphyton (attached algae) in streams and rivers. Minor enhancements were also made which improve simulation of macrophytes, fish, and dissolved oxygen. A typographic error was discovered in the documentation

relating to volatilization; the model code was correct. This addendum presents the specific changes to the Technical Documentation (EPA document number 823-R-01-007).
NTIS
*Ecosystems; Toxicity; Mathematical Models; Aquatic Plants*

**20020066490** Geological Survey, Portland, OR USA
**Pesticides in Surface Water of the Yakima River Basin, Washington, 1999-2000-Their Occurrence and an Assessment of Factors Affecting Concentrations and Loads** ***Final Report***
Ebbert, J. C.; Embrey, S. S.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): PB2002-105098; USGS-WRI-01-4211; No Copyright; Avail: National Technical Information Service (NTIS)
The occurrence, distribution, and transport of pesticides in surface water of the Yakima River Basin were assessed using data collected during 1999-1000 as part of the U.S. Geological Survey National Water Quality Assessment (NAWQA) Program. Samples were collected at 34 sites located throughout the basin in August 1999 using a Lagrangian sampling design. Samples also were collected weekly and monthly from May 1999 through January 2000 at three of the sites. This report includes data for 47 pesticide compounds from the analysis of filtered water using ocadecyl (C-18) solid-phase extraction and gas chromatography/mass spectrometry.
NTIS
*Pesticides; River Basins; Surface Water; Toxicity; Concentration (Composition); Geological Surveys*

**20020066510** Geological Survey, Water Resources Div., Lawrence, KS USA
**Sediment Deposition and Occurrence of Selected Nutrients and Other Chemical Constituents in Bottom Sediment, Tuttle Creek Lake, Northeast Kansas, 1962-99**
Juracek, K. E.; Mau, D. P.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): PB2002-107593; No Copyright; Avail: National Technical Information Service (NTIS)
A combination of bathymetric surveying and bottom-sediment coring was used to investigate sediment deposition and the occurrence of selected nutrients (total ammonia plus organic nitrogen and total phosphorus), 44 metals and trace elements, 15 organochlorine compounds, and 1 radionuclide in bottom sediment of Tuttle Creek Lake, northeast Kansas.
NTIS
*Deposition; Limnology; Sediments*

**20020066534** Geological Survey, Denver, CO USA
**Chain of Custody: Recommendations for Acceptance and Analysis of Evidentiary Geochemical Samples**
Murphy, C.; Briggs, P.; Adrian, B.; Wilson, S.; Hageman, P.; 2002; 36p
Report No.(s): PB2002-107872; USGS-CIRC-1138; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Personnel from the Analytical Chemistry Services Group (ACSG)is less than Mineral Resources SUrvey Program (MRSP), formed a team to determine the policies for acceptance and analysis of geochemical samples.
NTIS
*Geochemistry; Sampling; Policies*

**20020066535** Geological Survey, Water Resources Div., Tacoma, WA USA
**Estimates of Ground-Water Recharge from Precipitation to Glacial-Deposit and Bedrock Aquifers on Lopez, San Juan, Orcas, and Shaw Islands, San Juan County, Washington** ***Final Report***
Orr, L. A.; Bauer, H. H.; Wayenberg, J. A.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): PB2002-107592; USGS-WRI-02-4114; No Copyright; Avail: National Technical Information Service (NTIS)
An important source of fresh water on Lopez, San Juan, Orcas, and Shaw Islands in San Juan County off the northwestern coast of Washington is glacial-deposit and bedrock aquifers. Two methods were used to estimate recharge from precipitation to the water tables on the islands. A daily near-surface water-balance method, the Deep Percolation Model (DPM), was used to simulate water budgets for the period October 1, 1996, through September 30, 1998 (water years 1997-98) for six small drainage basins three on Lopez Island and one each on San Juan, Orcas, and Shaw Islands.
NTIS
*Ground Water; Aquifers; Water Tables*

**20020066538** Geological Survey, Reston, VA USA

**Ground-Water Discharge Determined from Measurements of Evapotranspiration, Other Available Hydrologic Components, and Shallow Water-Level Changes, Oasis Valley, Nye County, Nevada** ***Final Report***

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

Report No.(s): PB2002-107170; USGS-WRI-01-4239; No Copyright; Avail: National Technical Information Service (NTIS)

Oasis Valley is an area of natural groundwater discharge within the Death Valley regional ground-water flow system of southern Nevada and adjacent California. Ground water discharging at Oasis Valley is replenished from inflow derived from an extensive recharge area that includes the northwestern part of the Nevada Test Site (NTS). Because nuclear testing has introduced radionuclides into the subsurface of the NTS, the U.S. Department of Energy currently is investigating the potential transport of these radionuclides by ground water flow. to better evaluate any potential risk associated with these test-generated contaminants, a number of studies were undertaken to accurately quantify discharge from areas downgradient in the regional ground-water flow system from the NTS. This report refines the estimate of ground-water discharge from Oasis Valley.

NTIS

*Ground Water; Evapotranspiration; Water Vapor; Drainage*

**20020066543** Geological Survey, Denver, CO USA

**User's Guide to PHREEQC (Version 2): A Computer Program for Speciation, Batch-Reaction, One-Dimensional Transport, and Inverse Geochemical Calculations**

Parkhurst, D. L.; Appelo, C. A. J.; 1999; In English

Report No.(s): PB2002-107837; USGS/WRI-99-4259; No Copyright; Avail: National Technical Information Service (NTIS)

PHREEQC version 2 is a computer program written in the C programming language that is designed to perform a wide variety of low-temperature aqueous geochemical calculations. PHREEQC is based on an ion-association aqueous model and has capabilities for (1) speciation and saturation-index calculations; (2) batch-reaction and one-dimensional (1D) transport calculations involving reversible reactions, which include aqueous, mineral, gas, solid-solution, surface-complexation, and ion-exchange equilibria, and irreversible reactions, which include specified mole transfers of reactants, kinetically controlled reactions, mixing of solutions, and temperature changes; and (3) inverse modeling, which finds sets of mineral and gas mole transfers that account for differences in composition between waters, within specified compositional uncertainty limits. New features in PHREEQC version 2 relative to version 1 include capabilities to simulate dispersion (or diffusion) and stagnant zones in 1D-transport calculations, to model kinetic reactions with user-defined rate expressions, to model the formation or dissolution of ideal, multicomponent or nonideal, binary solid solutions, to model fixed-volume gas phases in addition to fixed-pressure gas phases, to allow the number of surface or exchange sites to vary with the dissolution or precipitation of minerals or kinetic reactants, to include isotope mole balances in inverse modeling calculations, to automatically use multiple sets of convergence parameters, to print user-defined quantities to the primary output file and (or) to a file suitable for importation into a spreadsheet, and to define solution compositions in a format more compatible with spreadsheet programs.

NTIS

*Geochemistry; Aqueous Solutions; Computer Programs; Water Quality; User Requirements; C (Programming Language)*

**20020066615** Geological Survey, Water Resources Div., Sacramento, CA USA

**Flux of Dissolved Forms of Mercury Across the Sediment-Water Interface in Lahontan Reservoir, Nevada**

Kuwabara, J. S.; Marvin-Dipasquale, M.; Praskins, W.; Bryon, E.; Topping, B. R.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): PB2002-107175; No Copyright; Avail: National Technical Information Service (NTIS)

Field and laboratory studies were conducted between April 30, 2001 and July 19, 2001 to provide the first direct measurements of the benthic flux of dissolved mercury species (total and methylated forms) between the bottom sediment and water column at three sites: two in the southern lobe and one in the northern lobe of Lahontan Reservoir, Nevada. Dissolved-mercury species and predominant ligands (represented by dissolved organic carbon, and sulfides) were the solutes of primary interest. Benthic flux, sometimes referred to as internal recycling, represents the transport of dissolved chemical species between the water column and the underlying sediment.

NTIS

*Reservoirs; Mercury Compounds; Methyl Compounds*

**20020066616** Geological Survey, Water Resources Div., Sacramento, CA USA

**Geohydrology of a Deep-Aquifer System Monitoring-Well Site at Marina, Monterey County, California** ***Final Report***

Hanson, R. T.; Everett, R. S.; Newhouse, M. W.; Crawford, S. M.; Pimentel, M. I.; 2002; In English

Report No.(s): PB2002-107173; USGS-WRI-02-4003; No Copyright; Avail: National Technical Information Service (NTIS)

In the Salinas Valley, located in the central coastal area of California, extensive agriculture and subsequent urbanization has resulted in extensive ground-water development and seawater intrusion within the upper-aquifer system. As a result, local water purveyors in the Marina area have installed water-supply wells in the deep-aquifer system to help meet water-resource needs. Because the hydrogeology of the deep-aquifer system is not well understood, the U.S. Geological Survey, as part of a cooperative study with the Monterey County Water Resources Agency (MCWRA), drilled Deep Monitoring Well 1 (DMW1) at a site between the coast and several supply wells a site between the coast and several supply wells that tap the deep aquifers within the Marina Coast Water District. This well, which includes four separate monitoring wells within the 2,000-foot-deep borehole, was installed during April and May 2000. The purpose of this well and the related investigation was to help resolve several hydrogeologic issues regarding the deep-aquifer system that were identified by local agencies.

NTIS

*Aquifers; Geological Surveys; Hydrogeology; Ground Water; Water Resources*

**20020066621** Geological Survey, Water Resources Div., Carson City, NV USA

**Selected Ground-Water Data for Yucca Mountain Region, Southern Nevada and Eastern California, Through December 1998**

2002; 98p; In English

Report No.(s): DE2002-794160; USGS-OFR-99-250; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The U.S. Geological Survey, in support of the U.S. Department of Energy, Yucca Mountain Site Characterization Project, collects, compiles, and summarizes hydrologic data in the Yucca Mountain region. The data are collected to allow assessments of groundwater resources during studies to determine the potential suitability of Yucca Mountain for storing high level nuclear waste. Data on ground-water levels at 34 wells and a fissure (Devils Hole), ground-water discharge at 5 springs and a flowing well, and total reported groundwater withdrawals within Crater Flat, Jackass Flats, Mercury Valley, and the Amargosa Desert are presented for calendar year 1998. Data collected prior to 1998 are graphically presented and data collected by other agencies (or as part of other Geological Survey programs) are included to further indicate variations of ground-water levels, discharges, and withdrawals through time.

NTIS

*Hydrology; Ground Water*

**20020066639** Raytheon Information Technology and Scientific Services, Lanham, MD USA

**Scientific Data Analysis and Software Support: Geodynamics** ***Final Report***

Klosko, Steven, Raytheon Information Technology and Scientific Services, USA; Dec. 11, 2000; 10p; In English

Contract(s)/Grant(s): NAS5-32352; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The support on this contract centers on development of data analysis strategies, geodynamic models, and software codes to study four-dimensional geodynamic and oceanographic processes, as well as studies and mission support for near-Earth and interplanetary satellite missions. SRE had a subcontract to maintain the optical laboratory for the LTP, where instruments such as MOLA and GLAS are developed. NVI performed work on a Raytheon laser altimetry task through a subcontract, providing data analysis and final data production for distribution to users. HBG had a subcontract for specialized digital topography analysis and map generation. Over the course of this contract, Raytheon ITSS staff have supported over 60 individual tasks. Some tasks have remained in place during this entire interval whereas others have been completed and were of shorter duration. Over the course of events, task numbers were changed to reflect changes in the character of the work or new funding sources. The description presented below will detail the technical accomplishments that have been achieved according to their science and technology areas. What will be shown is a brief overview of the progress that has been made in each of these investigative and software development areas. Raytheon ITSS staff members have received many awards for their work on this contract, including GSFC Group Achievement Awards for TOPEX Precision Orbit Determination and the Joint Gravity Model One Team. NASA JPL gave the TOPEX/POSEIDON team a medal commemorating the completion of the primary mission and a Certificate of Appreciation. Raytheon ITSS has also received a Certificate of Appreciation from GSFC for its extensive support of the Shuttle Laser Altimeter Experiment.

Author

*Software Engineering; Geodynamics; Oceanography; Support Systems; Computer Programming; Data Processing*

**20020066647** Geological Survey, Water Resources Div., Tallahassee, FL USA

**Analysis of Trends in Water-Quality Data for Water Conservation Area 3A, The Everglades, Florida** ***Final Report***

Mattraw, H. C.; Scheidt, D. J.; Federico, A. C.; 1987; 62p; In English

Report No.(s): PB2002-108162; USGS-WRI-87-4142; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Rainfall and water-quality data bases from the South Florida Water Management District were used to evaluate water-quality trends at 10 locations near or in Water Conservation Area 3A in The Everglades. The Seasonal Kendall test was applied to specific conductance, orthophosphate-phosphorus, nitrate-nitrogen, total Kjeldahl nitrogen, and total nitrogen regression residuals for the period 1978-82. residuals of orthophosphate and nitrate quadratic models, based on antecedent seven-day rainfall at inflow gate S-11B, were the only two constituent-structure pairs that showed apparent significant (p less than 0.05) increases in constituent concentrations. Elimination of regression models with distinct residual patterns and data outliers resulted in 17 statistically significant station-water quality combinations for trend analysis. No water-quality trends were observed.

NTIS

*Water Quality; Pollution Monitoring; Everglades (FL)*

**20020066682** Geological Survey, Water Resources Div., Tallahassee, FL USA

**Chemical and Hydrologic Assessment of the Caloosahatchee River Basin, Lake Okeechobee to Franklin Lock, Florida** ***Final Report***

2002; 72p; In English

Report No.(s): PB2002-108161; USGS-WRI-83-4126; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Annual discharge (1970-79 water years) from Lake Okeechobee to the Caloosahatchee River averaged 51 percent of the total river discharge at Franklin Lock and ranged from 10 to 71 percent of total discharge. Excluding rainfall on the river surface and upstream seepage, surface and subsurface runoff from the basin accounted for the remaining total river discharge at Franklin Lock.

NTIS

*Water Quality; River Basins*

**20020066683** Geological Survey, Water Resources Div., Richmond, VA USA

**Water Resources Data for Virginia, Water Year 2001. Volume 1., Volume 1, Surface-Water Discharge and Surface-Water Quality Records** ***Annual Report, 1 Oct. 2000 - 30 Sep. 2001***

White, R. K.; Hayes, D. C.; Guyer, J. R.; Herman, P. E.; 2001; 526p; In English

Report No.(s): PB2002-106379; USGS/WDR/VA-01-Vol-1; No Copyright; Avail: CASI; A23, Hardcopy; A04, Microfiche

Water-resources data for the 2001 water year for Virginia includes records of stage, discharge, and water quality of streams and stage, contents, and water quality of lakes and reservoirs. This volume contains records for water discharge at 160 gaging stations; stage only at 3 gaging stations; stage and contents at 10 lakes and reservoirs; and water quality at 23 gaging stations. Also included are data for 52 crest-stage partial-record stations. Location of these sites is shown on figures 4 and 5. Miscellaneous hydrologic data were collected at 86 measuring sites and 4 water-quality sampling sites not involved in the systematic data-collection program. The data in this report represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Virginia.

NTIS

*Water Resources; Data Acquisition; Virginia*

**20020066744** Geological Survey, Water Resources Div., Portland, OR USA

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

Herrett, T. A.; Hess, G. W.; House, J. G.; Ruppert, G. P.; Courts, M. L.; 2001; 460p; In English

Report No.(s): PB2002-107485; USGS/WDR-OR-01-1; No Copyright; Avail: CASI; A20, Hardcopy; A04, Microfiche

The Water Resources Division of the U.S. Geological Survey, in cooperation with state agencies, obtains a large amount of data pertaining to the water resources of Oregon each water year. These data, accumulated during many water years, constitute a valuable data base for developing an improved understanding of the water resources of the State. This report includes records on both surface and ground water in the State and contains discharge records for 186 stream-gaging stations, stage only records for 6 gaging station, 51 partial-record or miscellaneous streamflow stations, and 171 low-flow discharge at partial record stations and miscellaneous sites; 3 crest-stage partial-record streamflow stations; stage and content records for 26 lakes and reservoirs; water-quality records for 67 streamflow-gaging stations; water-quality for 2 atmospheric disposition stations and 6 ground-water sites.

NTIS

*Water Resources; Data Acquisition; Oregon*

**20020066745** Institute of Tropical Forestry, Rio Piedras, Puerto Rico

**Possibilitites and Approaches toward Community Forestry in the Caribbean: Proceedings of the Tenth Meeting of Caribbean Foresters**

Ruiz, B. I.; Wadsworth, F. H.; Miller, J. M.; Lugo, A. E.; 2001; 132p; In English

Report No.(s): PB2002-107337; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The 10th Caribbean Foresters Meeting continues a tradition that started in St. Lucia in May 1982. The United State Forest Service (USFS), through its International Institute of Tropical Forestry, located in Puerto Rico, has organized and sponsored this activity every two years since that time. The event brings together foresters and other government officials working in the wise use of their countries' forest resources. The participants of the meetings have selected and developed the following themes during the last nine meetings; effects of natural disasters, watershed management, forest recreation, wildlife management, wetlands management, sustainable forest resource management, and economics in Caribbean forestry, protected areas management, and biodiversity. The following countries have hosted the meetings: St. Lucia, St. Vincent and the Grenadines, Guadeloupe, Dominica, Trinidad and Tobago, Martinique, Jamaica, Grenada, and the Dominican Republic. The proceedings of each meeting have been published by the USFS each year between meetings. As we enter the new millennium and the third decade of this event, we are glad to be sponsoring it this year in collaboration with the Guyana Forestry Commission, the Puerto Rico Conservation Foundation and the Food and Agriculture Organization. The selected theme of the 10th Meeting is 'Possibilities and Approaches toward Community Forest.' It is our hope that the sharing of practical experiences and lessons learned by natural resource managers regarding this theme will further the conservation of the region's forests through the application of sound technical approaches and the active participation of local people.

NTIS

*Tropical Regions; Forest Management; Forests*

**20020066747** National Inst. of Standards and Technology, (BFRL), Gaithersburg, MD USA

**Community-Scale Fire Spread**

Rehm, R. G.; Hamins, A.; Baum, H. R.; McGrattan, K. B.; Evans, D. D.; Jul. 2002; 24p; In English

Report No.(s): PB2002-107932; NISTIR-6891; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper addresses community-scale fires, which have also been called urban/wildland interface or intermix fires. These fires arise when wildland fires invade the built environment and attack structures as well as wildland fuels. The prediction of the spread of wildland fires, such as those occurring out West during the summer of 2000, has been accomplished through 'operational' mathematical models. These models are based on empirical correlations for wildland fuels and have generally performed well. They fail, however, when the fire spreads to the built environment where the empirical correlations no longer apply and where there is greatly increased potential for property damage, injury and death. The Oakland and Berkeley Hills fire of October 21, 1991, and the Los Alamos fires of May 2000 are examples of community-scale fires. The potential fuel loadings for various land uses demonstrates that structures generally provide much higher loadings than wildlands do. While this comparison is useful, it could also be misleading since generally, not all of the potential fuel in either the wildland or the built environment will burn. Furthermore, often the time scales for ignition and the heat release rates for the wildland fuel and the fuel in the structures will be widely disparate, and these differences will influence both the spread rate of the fire and its persistence. Although the NIST computational model known as the Fire Dynamic Simulator (FDS) was developed to study building fires, it is now being extended to study community-scale fires. These extensions require much higher resolution data on local topography, buildings, vegetation, and meteorological conditions. They also require additional research on the mechanisms by which fires spread in the build environment between discrete elements, such as structures or structures and trees.

NTIS

*Fires; Cities*

**20020066772** NVI, Inc., Greenbelt, MD USA

**Support for the Laboratory for Terrestrial Physics for Dynamics of the Solid Earth (DOSE)** ***Final Report, 8 Jan. 1993 - 31 Jan. 2001***

Jan. 31, 2001; 9p; In English

Contract(s)/Grant(s): NAS5-32331; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This final report summarizes the accomplishments during the contract period. Under the contract NVI, Inc. provided support to the VLBI group at NASA's Goddard Space Flight Center. The contract covered a period of approximately eight years during which geodetic and astrometric VLBI evolved through several major changes. This report is divided into four sections which

correspond to major task areas in the contract: A) Coordination and Scheduling, B) Field System, C) Station Support, and D) Analysis and Research and Development.
Derived from text
*Astrometry; Very Long Base Interferometry; Geodesy; Terrestrial Planets*

**20020066787** Geological Survey, Water Resources Div., Trenton, NJ USA
**Water Resources Data for New Jersey Water Year 2001. Volume 3. Water-Quality Data**
DeLuca, M. J.; Hoppe, H. L.; Doyle, H. A.; Gray, B. J.; 2002; 600p; In English
Report No.(s): PB2002-107486; USGS-WDR-NJ-01-3; No Copyright; Avail: CASI; A25, Hardcopy; A06, Microfiche

Water-resources data for the 2001 water year for New Jersey are presented in three volumes, and consists of records of stage, discharge, and quality of streams; stage and contents of lakes and reservoirs; and levels and quality of ground water. Volume 3 contains a summary of surface- and ground-water hydrologic conditions for the 2001 water year, a listing of current water-resources projects in New Jersey, a bibliography of water-related reports, articles and facts sheets for New Jersey completed by the Geological Survey in recent years, water-quality records of chemical analyses from 128 continuing-record surface-water stations, 29 miscellaneous surface-water sites, 53 ground-water sites, and records of daily statistics of temperature and other physical measurements from 44 continuous-recording stations. Locations of water-quality stations are shown in figures 22-24. Locations of miscellaneous water-quality sites are shown in figures 59-64. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating federal, state, and local agencies in New Jersey.
NTIS
*Water Resources; Data Acquisition; Water Quality; New Jersey*

## 43
## EARTH RESOURCES AND REMOTE SENSING

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

**20020065352** Defence Research Establishment Ottawa, Ottawa, Ontario Canada
**Shoreline Mapping Using Interferometric SAR**
Mattar, Karim E.; Buchheit, Max; Beaudoin, Andre; Jan. 2001; 40p; In English; Original contains color images
Report No.(s): AD-A403581; DREO-TR-2001-078; DREO-TR-2001-078; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Coherence from repeat-pass Satellite Radar Interferometry (SRI) is explored as a means for shoreline mapping and water body masking. In temperate environments the coast may be outlined by the difference between the high coherence of the land and the absence of coherence in the sea/ocean. However, it is found that in coastal regions scene decorrelation from a variety of sources often dominate the image, making it difficult or impossible to distinguish the shoreline. In an arctic climate where scene decorrelation is reduced and the sea is frozen, the shoreline is often clearly outlined by a thin region of low coherence separating the land from frozen ice that is subjected to continuous tidal shear forces. Lakes are similarly outlined by a reduction in the coherence.
DTIC
*Interferometry; Remote Sensing; Mapping; Masking*

**20020066559** Physics and Electronics Lab. TNO, The Hague, Netherlands
**Visual and IR Point Detection Experiments During RED, August-September 2001 in Hawaii** ***Final Report, Aug. - Sep. 2001***
deJong, A. N., Physics and Electronics Lab. TNO, Netherlands; May 2002; 40p; In English; Original contains color illustrations
Contract(s)/Grant(s): TNO Proj. 26635
Report No.(s): TD01-0267; FEL-01-A311; Copyright; Avail: Issuing Activity

TNO-FEL participated at the RED (Rough Evaporation Duct) trials near Oahu (Hawaii) with a near-IR (infrared) and a midwave IR (3-5 micrometer) camera for observations of point targets, mounted on a floating platform (FLIP). Data were collected at ranges of about 16 and 26 km, while the optical path was grazing the ocean surface. In this way propagation effects could be investigated, as created in the lowest part of the marine boundary layer. of these effects, the refraction and scintillation

are the most important for the point target detection. The atmosphere near Oahu with its constant eastern trade winds was constantly subrefractive, creating an optical ducting layer with increased point target detection capability.
Author
*Infrared Detectors; Atmospheric Refraction; Target Recognition; Infrared Photography; Surveillance*

**20020066751** Geological Survey, National Mapping Div., Reston, VA USA
**National Map: Topographic Mapping for the 21st Century** ***Final Report***
Nov. 30, 2001; 42p; In English
Report No.(s): PB2002-107838; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The report describes the vision by which the U.S. Geological Survey (USGS), working with partners, will provide the Nation with current, accurate, and nationally consistent basic spatial data, including digital data and derived topographic maps, and deliver spatial information that is current. Issues discussed include the form USGS maps and spatial data will take, ways that lag time between changes on the ground and corresponding updates in data and on maps can be reduced, and means by which the USGS can create and maintain these data and maps.
NTIS
*Topography; Mapping*

**20020067406** Arizona Univ., Office of Sponsored Projects, Tucson, AZ USA
**Radiometric and Spatial Characterization of High-Spatial Resolution Sensors**
Thome, Kurtis, Arizona Univ., USA; [2002]; 5p; In English
Contract(s)/Grant(s): NAG13-02044; RTOP 609-00-00-00-00-64; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
The development and improvement of commercial hyperspatial sensors in recent years has increased the breadth of information that can be retrieved from spaceborne and airborne imagery. NASA, through it's Scientific Data Purchases, has successfully provided such data sets to its user community. A key element to the usefulness of these data are an understanding of the radiometric and spatial response quality of the imagery. This proposal seeks funding to examine the absolute radiometric calibration of the Ikonos sensor operated by Space Imaging and the recently-launched Quickbird sensor from DigitalGlobe. In addition, we propose to evaluate the spatial response of the two sensors. The proposed methods rely on well-understood, ground-based targets that have been used by the University of Arizona for more than a decade.
Author
*High Resolution; Spatial Resolution; Radiometers; Calibrating*

**20020067408** Atmospheric and Environmental Research, Inc., Lexington, MA USA
**Real Time Monitoring of Flooding from Microwave Satellite Observations** ***Quarterly Report, 1 Apr. - 30 Jun. 2001***
Galantowicz, John F., Atmospheric and Environmental Research, Inc., USA; Jul. 18, 2001; 14p; In English
Contract(s)/Grant(s): NAS5-00189; SENH99-0000-0125
Report No.(s): AER-P870-RP-I-QR3-20010718; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
In this report, we review the progress to date including results from data analyses and present a schedule of milestones for the remainder of the project. We discuss the processing of flood extent data and SSM/I brightness temperature data for the 1993 Midwest Flood. We present preliminary results from the derivation of open water fraction from brightness temperatures.
Author
*Data Processing; Floods; Microwaves; Real Time Operation; Satellite Observation*

**20020067450** Massachusetts Inst. of Tech., Lincoln Lab., Lexington, MA USA
**Comparison of the EO-1 Advanced Land Imager Performance With the LANDSAT Data Continuity Mission Specification**
Mendenhall, J. A.; Hearn, D. R.; Lencioni, D. E.; Jun. 04, 2002; 98p; In English; Original contains color images
Contract(s)/Grant(s): F19628-00-C-0002
Report No.(s): AD-A403445; PR-EO-1-8; ESC-TR-2001-069; No Copyright; Avail: CASI; A05, Hardcopy
The performance requirements for the Advanced Land Imager were developed under NASA's New Millennium Program and were intended to facilitate the validation of new sensor technologies and architectures for potential application in future remote sensing missions. The Advanced Land Imager (ALI) was designed and flown well before the LANDSAT Data Continuity Mission (LDCM) specifications were developed. Nevertheless, the science focus of the ALI technology validation was LANDSAT data continuity. Therefore, although exact compliance by ALI is not expected, the performance should demonstrate a path to a compliant sensor system. The performance of the ALI, as determined from preflight and flight data, is compared to the LDCM

specification. Twenty-one noncompliances have been identified: four data collection, four spectral, six spatial, and seven radiometric (Table I). All but six of these are considered minor. The six major noncompliances are the result of stray light, leaky detectors, and contamination. Appendix A replicates the LDCM specification and contains ALI compliance notes where appropriate. Details of the ALI stray light, contamination, and leaky detectors are provided in Appendix B, C, and D respectively. Additional information pertaining to the calculation of the ALI edge response and coherent noise is presented in Appendix E and F. A list of ALI related publications is provided in Appendix G.
DTIC
*Satellite Imagery; LANDSAT Satellites; Data Acquisition; Radiometers*

## 44
## ENERGY PRODUCTION AND CONVERSION

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

**20020065314** Corps of Engineers, Washington, DC USA
**Engineering and Design: Transformer Application Guidance**
Kennon, Herbert H.; Oct. 20, 1989; 19p; In English
Report No.(s): AD-A403370; ETL-1110-3-412; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This letter provides advance criteria for design of transformers, prior to update of current guide specifications.
DTIC
*Transformers; Engineering; Design*

**20020065325** Corps of Engineers, Washington, DC USA
**Engineering and Design: Reliability Analysis of Hydropower Equipment**
May 30, 1997; 42p; In English
Report No.(s): AD-A403340; CECW-EE; ETL-1110-2-550; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This engineer technical letter (ETL) provides basic guidance for assessing the reliability of hydropower equipment and establishes an engineering basis for rehabilitation investment decisions. The methodology, concepts, and background information are briefly stated with further explanation and examples in the appendices. This letter also references the hydropower benefits analysis and the economic models as they relate to hydropower rehabilitation projects.
DTIC
*Hydroelectricity; Reliability Engineering*

**20020065376** Corps of Engineers, Washington, DC USA
**Engineering and Design: Selecting Reaction-Type Hydraulic Turbines and Pump Turbines and Hydroelectric Generators and Generator-Motors**
Dec. 15, 1988; 161p; In English
Report No.(s): AD-A403270; USACE-ETL-1110-2-317; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche
This letter provides advance criteria for selection of Reaction-Type Hydraulic Turbines and Pump Turbines and Generators and Generator motors. This criteria is to be used pending incorporation into an Engineering Manual.
DTIC
*Turbines; Generators; Hydroelectricity*

**20020065548** Argonne National Lab., IL USA
**Investigation of the Resistance Rise and Power Fade in High-Power Li-ion Cells**
Bloom, I.; Jones, S. A.; Battaglia, V. S.; Polzin, E. G.; Henriksen, G. L.; Mar. 2002; 18p; In English
Report No.(s): DE2002-793078; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Two different cell chemistries, Gen 1 and Gen 2, were subjected to accelerated aging experiments. In Gen 1 calendar-life experiments, useful cell life was strongly affected by temperature and time. Higher temperatures accelerated the degradation of

cell performance. The rates of resistance increase and power fade followed simple laws based on a power of time and Arrhenius kinetics. The data have been modeled using these two concepts, and the calculated data agree well with the experimental values.
NTIS
*Lithium Batteries; Solid Electrolytes; Resistance; Aging (Materials); Metal Ions*

**20020066130** Southern States Energy Board, GA USA
**Developing State Policies Supportive of Bioenergy Development** ***Progress Report, 1 Jul. -20 Sep. 2001***
Baskin, K.; Oct. 31, 2001; 26p; In English
Report No.(s): DE2002-794959; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Working within the context of the Southern States Biobased Alliance (SSBA) and with officials in each state, the Southern States Energy Board (SSEB) is identifying bioenergy related policies and programs within each state to determine their impact on the development, deployment or use of bioenergy. In addition, SSEB will determine which policies have impacted industry's efforts to develop, deploy or use biobased technologies or products. As a result, SSEB will work with the Southern States Biobased Alliance to determine how policy changes might address any negative impacts or enhance positive impacts.
NTIS
*Energy Sources; Biomass; Crops; Biotechnology; Policies*

**20020066131** Southern States Energy Board, GA USA
**Developing State Policies Supportive of Bioenergy Development** ***Progress Report, 1 Mar. - 30 Jun. 2001***
Baskin, K.; Jul. 31, 2001; 20p; In English
Report No.(s): DE2002-794958; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Working within the context of the Southern States Biobased Alliance (SSBA) and with officials in each state, the Southern States Energy Board (SSEB) is identifying bioenergy related policies and programs within each state to determine their impact on the development, deployment or use of bioenergy. In addition, SSEB will determine which policies have impacted industry's efforts to develop, deploy or use biobased technologies or products. As a result, SSEB will work with the Southern States Biobased Alliance to determine how policy changes might address any negative impacts or enhance positive impacts.
NTIS
*Energy Sources; Biomass; Crops; Biotechnology; Policies*

**20020066254** National Energy Technology Lab., Pittsburgh, PA USA
**Developing State Policies Supportive of Bioenergy Development** ***Progress Report, 1 Oct. - 31 Dec. 2001***
Baskin, K.; Jan. 31, 2002; 10p; In English
Report No.(s): DE2002-794960; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Working within the context of the Southern States Biobased Alliance (SSBA) and with officials in each state, the Southern States Energy Board (SSEB) is identifying bioenergy related policies and programs within each state to determine their impact on the development, deployment or use of bioenergy. In addition, SSEB will determine which policies have impacted industry's efforts to develop, deploy or use biobased technologies or products. As a result, SSEB will work with the Southern States Biobased Alliance to determine how policy changes might address any negative impacts or enhance positive impacts.
NTIS
*Energy Sources; Biomass; Crops; Deployment; Biotechnology*

**20020066310** National Renewable Energy Lab., Washington, DC USA
**Field Performance of Hybrid Power Systems**
Baring-Gould, E. I.; Newcomb, C.; Corbus, D.; Kalidas, R.; Sep. 2001; In English
Report No.(s): DE2002-30566; NREL/CP-500-30566; No Copyright; Avail: National Technical Information Service (NTIS)
The increasing costs of line extensions and fossil fuel, combined with the desire to reduce foreign exchange charges, are encouraging various countries to consider using renewable energy technologies in rural electrification programs. There is much anecdotal information about the operation of small wind-hybrid systems, but a lack of high-quality, well-documented information allowing a clear understanding of true performance and costs of such systems. Through the detailed monitoring and evaluation of pilot systems, a large discrepancy has been found between the power produced by small wind turbines in a hybrid application and energy production estimates based on the sites climatic conditions and the turbine power curve. The reasons for this discrepancy vary but can result in a 75% reduction in turbine output. Partial solutions include the wider use of discretionary loads

and improved system control. System design impact should be considered and computer models need to be evaluated to accurately assess this problem.
NTIS
*Hybrid Structures; Performance Prediction; Energy Technology; Climatology; Electric Generators*

**20020066407** National Renewable Energy Lab., Golden, CO USA
**Wind Turbine Lightning Protection Project. 1999-2001**
McNiff, B.; May 2002; In English; This document is color dependent and/or in landscape layout. It is currently ony available on CD-ROM
Report No.(s): DE2002-31115; NREL/SR-500-31115; No Copyright; Avail: National Technical Information Service (NTIS)
The National Renewable Energy Laboratory (NREL) instituted a lightning protection research and support program to help minimize lightning damage to wind turbines in the USA. The chief goal was to further the understanding of effective lightning damage mitigation techniques throughout the U.S. wind industry. to that end, three main efforts were carried out: a field test program; evaluation and documentation of protection on selected turbines; and a literature search and effective dissemination of the accumulated information. The results of these efforts are reported in this document.
NTIS
*Lightning; Renewable Energy; Wind Turbines; Power Plants*

**20020066408** National Renewable Energy Lab., Golden, CO USA
**Study of a Wind Farm Power System**
Muljadi, E.; Wan, Y.; Butterfield, C. P.; Parsons, B.; Jan. 2002; In English; This document is color dependent and/or in landscape layout. It is currently ony available on CD-ROM
Report No.(s): DE2002-30814; NREL/CP-500-30814; No Copyright; Avail: National Technical Information Service (NTIS)
A wind power system differs from a conventional power system. In a conventional power plant, the operator can control the plant's output. The output of a wind farm cannot be controlled because the output fluctuates with the wind. In this paper, we investigate the power-system interaction resulting from power variations at wind farms using steady-state analysis.
NTIS
*Windpower Utilization; Windpowered Generators; Industrial Plants; Electric Potential*

**20020066409** National Renewable Energy Lab., Golden, CO USA
**Cogging Torque Reduction in a Permanent Magnet Wind Turbine Generator. Preprint**
Muljadi, E.; Green, J.; Jan. 2002; In English; This document is color dependent and/or in landscape layout. It is currently ony available on CD-ROM
Report No.(s): DE2002-30768; NREL/CP-500-30768; No Copyright; Avail: National Technical Information Service (NTIS)
In this paper, we investigate three design options to minimize cogging torque: uniformity of air gap, pole width, and skewing. Although the design improvement is intended for small wind turbines, it is also applicable to larger wind turbines.
NTIS
*Generators; Wind Turbines*

**20020066412** National Renewable Energy Lab., Golden, CO USA
**Unsteady Aerodynamics Experiment, Phase VI, Wind TUnnel Test Configurations and Available Data Campaigns**
Hand, M. M.; Simms, D. A.; Fingersh, L. J.; Jager, D. W.; Cotrell, J. R.; Dec. 2001; In English; This document is color dependent and/or in landscape layout. It is currently ony available on CD-ROM
Report No.(s): DE2002-29955; NREL/TP-500-29955; No Copyright; Avail: National Technical Information Service (NTIS)
The primary objective of the unsteady aerodynamics experiment was to provide information needed to quantify the full-scale, three-dimensional aerodynamic behavior of horizontal-axis wind turbines. This report is intended to familiarize the user with the entire scope of the wind tunnel test and to support the use of the resulting data.
NTIS
*Wind Tunnels; Aerodynamics*

**20020066413** National Renewable Energy Lab., Golden, CO USA

**Impurity Precipitation, Dissolution, Gettering, and Passivation in PV Silicon** ***Final Report, 30 Jan. 1998 - 29 Aug. 2001***

Weber, E. R.; Feb. 2002; In English; This document is color dependent and/or in landscape layout. It is currently ony available on CD-ROM

Report No.(s): DE2002-31528; NREL/SR-520-31528; No Copyright; Avail: National Technical Information Service (NTIS)

This report describes the major progress in understanding the physics of transition metals in silicon and their possible impact on the efficiency of solar cells that was achieved during the three-year span of this subcontract. We found that metal-silicide precipitates and dissolved 3d transition metals can be relatively easily gettered. Gettering and passivating treatments must take into account the individuality of each transition metal. Our studies demonstrated how significant is the difference between defect reactions of copper and iron. Copper does not significantly affect the minority-carrier diffusion length in p-type silicon, at least as long as its concentration is low, but readily precipitates in n-type silicon. Therefore, copper precipitates may form in the area of p-n junctions and cause shunts in solar cells. Fortunately, copper precipitates are present mostly in the chemical state of copper-silicide and can relatively easily be dissolved. In contrast, iron was found to form clusters of iron-oxides and iron-silicates in the wafers. These clusters are thermodynamically stable even in high temperatures and are extremely difficult to remove. The formation of iron-silicates was observed at temperatures over 900 C.

NTIS

*Dissolving; Getters; Impurities; Passivity; Precipitates; Solar Cells*

**20020066430** National Renewable Energy Lab., Golden, CO USA

**Silicon-Film(TM) Solar Cells by a Flexible Manufacturing System** ***Final Report, 16 Apr. 1998 - 31 Mar. 01***

Rand, J.; Feb. 2002; In English; This document is color dependent and/or in landscape layout. It is currently ony available on CD-ROM

Report No.(s): DE2002-30881; NREL/SR-520-30881; No Copyright; Avail: National Technical Information Service (NTIS)

This report describes the overal goal to engineer and develop flexible manufacturing methods and equipment to process Silicon-Film. solar cells and modules. Three major thrusts of this three-year effort were to: develop a new larger-area (208 mm x 208 mm) Silicon-Film. solar cell, the APx-8; construct and operate a new high- throughput wafer-making system; and develop a 15-MW single-thread manufacturing process. Specific technical accomplishments from this period are: Increase solar cell area by 80%, increase the generation capacity of a Silicon-Film wafer-making system by 350%, use a new in-line HF etch system in solar cell production, design and develop an in-line NaOH etch system, eliminate cassettes in solar cell processing, and design a new family of module products.

NTIS

*Manufacturing; Solar Cells; Silicon Films; Photovoltaic Cells*

**20020066436** Corps of Engineers, Washington, DC USA

**Engineering and Design: Lifeline Report No. 1, Systems at Risk From Earthquakes, Hydroelectric Power Plant Facilities**

Sep. 30, 1994; 44p; In English

Report No.(s): AD-A403351; CECW-ED; ETL-1110-2-533; No Copyright; Avail: CASI; A03, Hardcopy

This engineer technical letter (ETL) provides information on the vulnerability of electrical power-generating equipment and power plant facilities equipment to earthquake ground motions.

DTIC

*Hydroelectricity; Hydroelectric Power Stations; Vulnerability; Electric Equipment*

**20020066536** Netherlands Energy Research Foundation, Petten, Netherlands

**Lightning Damage of OWECS, Part 1, Parameters Relevant for Cost Modelling**

Rademakers, L.; Braam, H.; Wessels, H. R. A.; Prins, R. K. N.; Lok, R.; Jun. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): PB2002-107672; ECN-C-02-053; Copyright; Avail: National Technical Information Service (NTIS)

Presently, plans are being developed in Europe to develop large offshore wind farms. If the present generation of wind turbines will be place offshore, the repair of the lightning damages will be much more expensive. First of all, the costs for repairing lightning damage are higher offshore than onshore, because more expensive transportation equipment (supply vessels or helicopters) and cranes are needed. Secondly, the downtime for certain damage events and thus the revenue losses will be higher because repair can only be carried out if the weather conditions are suitable for the equipment. The actual damage due to lightning for offshore wind turbines in terms of costs and downtime can hardly be estimated accurately with the current knowledge. If any estimation is made, it is covered with large uncertainties. This will lead to higher insurance premiums. For financiers these uncertainties are

considered as a financial risk, which is a complicating factor for financing offshore wind projects. Hence, understanding of the costs resulting from lightning damage and quantification of the expected uncertainties in these costs facilitates the judgment of this risk and is of great importance.
NTIS
*Damage; Lightning; Windpower Utilization; Wind Turbines*

**20020066537** Netherlands Energy Research Foundation, Petten, Netherlands
**Lightning Damage of OWECS, Part 3, Case Studies**
Braam, H.; Rademakers, L.; Wessels, H. R. A.; Prins, R. K. N.; Lok, R.; Jun. 2002; 54p; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): PB2002-107673; ECN-C-02-054; Copyright; Avail: National Technical Information Service (NTIS)

Presently, plans are being developed in Europe to develop large offshore wind farms. If the present generation of wind turbines will be place offshore, the repair of the lightning damages will be much more expensive. First of all, the costs for repairing lightning damage are higher offshore than onshore, because more expensive transportation equipment (supply vessels or helicopters) and cranes are needed. Secondly, the downtime for certain damage events and thus the revenue losses will be higher because repair can only be carried out if the weather conditions are suitable for the equipment. The actual damage due to lightning for offshore wind turbines in terms of costs and downtime can hardly be estimated accurately with the current knowledge. If any estimation is made, it is covered with large uncertainties. This will lead to higher insurance premiums. For financiers these uncertainties are considered as a financial risk, which is a complicating factor for financing offshore wind projects. Hence, understanding of the costs resulting from lightning damage and quantification of the expected uncertainties in these costs facilitates the judgment of this risk and is of great importance.
NTIS
*Lightning; Windpower Utilization; Weather; Damage Assessment*

**20020066547** National Renewable Energy Lab., Golden, CO USA
**Systematic Controller Design Methodology for Variable-Speed Wind Turbines**
Hand, M. M.; Balas, M. J.; Feb. 2002; In English
Report No.(s): DE2002-29415; NREL/TP-500-29415; No Copyright; Avail: National Technical Information Service (NTIS)

Variable-speed, horizontal axis wind turbines use blade-pitch control to meet specified objectives for three operational regions. This paper provides a guide for controller design for the constant power production regime. A simple, rigid, non-linear turbine model was used to systematically perform trade-off studies between two performance metrics. Minimization of both the deviation of the rotor speed from the desired speed and the motion of the actuator is desired. The robust nature of the proportional-integral-derivative controller is illustrated, and optimal operating conditions are determined. Because numerous simulation runs may be completed in a short time, the relationship between the two opposing metrics is easily visualized.
NTIS
*Wind Turbines; Control Systems Design; Windpower Utilization; Rotor Speed; Controllers*

**20020066570** National Renewable Energy Lab., Golden, CO USA
**What is Happening with Independent System Operators. Conference Paper**
Porter, K. L.; Feb. 1999; 18p; In English
Report No.(s): DE2002-24584; NREL/CP-620-24584; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Emerging independent system operators (ISOs) appear to have many advantages for the wind power industry. This paper compares some past research on wind and transmission issues with some of the developments in ISO design and implementation.
NTIS
*Electric Power Transmission; Windpower Utilization*

**20020066572** Weizmann Inst. of Science, Rehovot, Israel

**Overcoming Degradation Mechanisms in CdTe Solar Cells** ***Final Report, Jul. 1998 - Sep. 01***

Mar. 2002; 44p; In English

Report No.(s): DE2002-31912; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Specifically, the objectives of this project were to investigate the back 'ohmic' contact to the p-CdTe film in the CdTe/CdS cell, with the aim of improving the stability of this contact while maintaining performance. The following approaches were among those involved in this study: (1) Separate back contact lifetime performance from overall cell lifetime performance. (2) Investigate new back contact materials. (3) Explore use of surface treatment of the CdTe to modify the contact.

NTIS

*Solar Cells; Degradation; Stability; Cadmium Tellurides*

**20020066584** National Renewable Energy Lab., Golden, CO USA

**NREL Large-Scale Turbine Inflow and Response Experiment-Preliminary Results**

Kelley, N.; Hand, M.; Larwood, S.; McKenna, E.; Jan. 2002; 22p; In English

Report No.(s): DE2002-30917; NREL/CP-500-30917; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The accurate numerical dynamic simulation of new large-scale wind turbine designs operating over a wide range of inflow environments is critical because it is usually impractical to test prototypes in a variety of locations. Large turbines operate in a region of the atmospheric boundary layer that currently may not be adequately simulated by present turbulence codes. In this paper, we discuss the development and use of a 42-m (137-ft) planar array of five, high-resolution sonic anemometers upwind of a 600-kW wind turbine at the National Wind Technology Center (NWTC). The objective of this experiment is to obtain simultaneously collected turbulence information from the inflow array and the corresponding structural response of the turbine. The turbulence information will be used for comparison with that predicted by currently available codes and establish any systematic differences. These results will be used to improve the performance of the turbulence simulations. The sensitivities of key elements of the turbine aeroelastic and structural response to a range of turbulence-scaling parameters will be established for comparisons with other turbines and operating environments. In this paper, we present an overview of the experiment, and offer examples of two observed cases of inflow characteristics and turbine response collected under daytime and nighttime conditions, and compare their turbulence properties with predictions.

NTIS

*Wind Turbines; Air Flow*

**20020066623** Department of Energy, Idaho Operations Office, Idaho Falls, ID USA

**Federal Geothermal Research Program Update Fiscal Year 2000**

Aug. 2001; 186p; In English

Report No.(s): DE2002-794382; DOE/ID-10907; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Department of Energy (DOE) and its predecessors have conducted research and development (R&D) in geothermal energy since 1971. to develop the technology needed to harness the Nation's vast geothermal resources, DOE's Office of Wind and Geothermal Technologies oversees a network of national laboratories, industrial contractors, universities, and their subcontractors. The following mission and goal statements guide the overall activities of the Office of Geothermal and Wind Technologies. to work in partnership with U.S. industry to establish geothermal energy as an economically competitive contributor to the US energy supply.

NTIS

*Geothermal Resources; Hydrothermal Systems*

**20020066628** Department of Energy, Office of Energy Efficiency and Renewable Energy, Washington, DC USA

**Using Distributed Energy Resources. A How-To Guide for Federal Facility Managers**

May 2002; 20p; In English

Report No.(s): DE2002-31570; DOE/GO-102002-1520; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

As one of today's busy Federal facility or energy managers, you may be seeking ways to solve problems such as high energy costs or low electric power reliability at your facility. If so, distributed energy resources (DER) could be the solution you're looking for. Distributed energy resources are small, modular, energy generation and storage technologies that provide electric capacity or energy where you need it. Typically producing less than 10 megawatts (MW) of power, DER systems can usually be sized to meet your particular needs and installed on site. DER systems may be either connected to the local electric power grid

or isolated from the grid in stand-alone applications. DER technologies include wind turbines, photovoltaics (PV), fuel cells, microturbines, reciprocating engines, combustion turbines, cogeneration, and energy storage systems. As one of today's busy Federal facility or energy managers, you may be seeking ways to solve problems such as high energy costs or low electric power reliability at your facility. If so, distributed energy resources (DER) could be the solution you're looking for.
NTIS
*Photovoltaic Conversion; Wind Turbines; Energy Technology; Cogeneration*

**20020066629** Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
**Wind Power Today. Wind Energy Program Highlights**
May 2002; In English; This document is color dependent and/or in landscape layout. It is currently ony available on CD-ROM
Report No.(s): DE2002-31583; DOE/GO-102002-1556; No Copyright; Avail: National Technical Information Service (NTIS)
Contents include the following: Wind Industry Experiences Record Growth in 2001; Taking Advantage of Low Wind Speeds-The Advancing Technology; Distributed Applications Growing for Small Wind Turbines; The DOE Wind Energy Program in Review.
NTIS
*Windpower Utilization; Wind Turbines; Technology Utilization*

**20020066634** Curry and Kerlinger, LLC, Cape May Point, NJ USA
**Assessment of the Impacts of Green Mountain Power Corporation's Wind Power Facility on Breeding and Migrating Birds in Searsburg, Vermont. Subcontractor Report** ***Progress Report***
Kerlinger, P.; Mar. 2002; 98p; In English
Report No.(s): DE2002-28591; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
A 6-megawatt, 11 turbine wind power development was constructed by Green Mountain Power Corporation in Searsburg, southern Vermont, in 1996. to determine whether birds were impacted, a series of modified BA (Before, After) studies was conducted before construction (1993-1996), during (1996), and after (1997) construction on the project site. The studies were designed to monitor changes in breeding bird community (species composition and abundance) on the site, examine the behavior and numbers of songbirds migrating at night over the site and hawks migrating over the site in daylight, and search for carcasses of birds that might have collided with the turbines. Overall, results of the studies suggest that the Searsburg, Vermont wind power facility does not pose a major threat to avian populations that breed on the site or migrate through the site. However, fewer interior forest breeding songbirds were heard singing in the area immediately surrounding the turbines. This effect may be transitory in that these birds may habituate and recognize as the sites are partially reforested. However, until this is demonstrated, this disturbance should be recognized as a potential impact of this type of development, especially in northeastern forests.
NTIS
*Birds; Breeding (Reproduction); Mountains; Vermont; Windpower Utilization*

**20020066640** National Renewable Energy Lab., Golden, CO USA
**Analyzing Two Federal Building-Integrated Photovoltaic Projects Using ENERGY-10 Simulations. Conference Paper**
Walker, A.; Balcomb, D.; Beaver, N.; Kiss, G.; BeckerHumphrey, M.; Mar. 2002; In English
Report No.(s): DE2002-31310; NREL/CP-710-31310; No Copyright; Avail: National Technical Information Service (NTIS)
A new version of the ENERGY-10 computer program simulates the performance of photovoltaic systems, in addition to presenting a wide range of opportunities to improve energy efficiency in buildings. This paper describes two test cases in which the beta release of ENERGY-10 version 1.4 was used to evaluate energy efficiency and building-integrated photovoltaics (BIPV) for two Federal building projects: an office and laboratory building at the Smithsonian Astrophysical Laboratory in Hilo, Hawaii, and housing for visiting scientists at the Smithsonian Environmental Research Center in Edgewater, Maryland. The paper describes the capabilities of the software, the method in which ENERGY-10 was used to assist in the design, and the results. ENERGY-10 appears to be an effective tool for evaluating BIPV options early in the building design process. By simulating both the building electrical load and simultaneous PV performance for each hour of the year, the ENERGY-10 program facilitates a highly accurate, integrated analysis.
NTIS
*Computer Programs; Photovoltaic Conversion; Computerized Simulation; Buildings*

**20020066688** Florida Solar Energy Center, Cape Canaveral, FL USA

**Culn(sub 1-x)Ga(sub x)Se(sub 2) Thin Film Solar Cells** ***Final Report, 5 Jan. 1998 - 31 Oct. 2001***

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

Report No.(s): DE2002-31533; No Copyright; Avail: National Technical Information Service (NTIS)

This report describes the development of CIGS2 thin-film solar cells on glass and stainless-steel foil substrates; fabrication of a large-area, dual-chamber magnetron-sputtering unit; Round Robin AES and SIMS analysis; and current-voltage characteristics of CdTe modules and analysis of CdTe module samples. More detailed results on CIGS2 cells and the large-area, dual-chamber magnetron-sputtering unit were presented at the MRS Conference, the European PV Conference, and NCPV Program Review Meeting and are included in Appendices I, II, and III. The results of Round Robin AES and SIMS analysis were submitted to the National CIGS Team Meeting. The current-voltage characteristics of CdTe modules and results of analyses of CdTe module samples were submitted separately to NREL and First Solar.

NTIS

*Cadmium Tellurides; Metal Foils; Solar Cells; Stainless Steels; Thin Films*

**20020066689** National Renewable Energy Lab., Golden, CO USA

**Final Report for Annex II-Assessment of Solar Radiation Resources in Saudi Arabia 1998-2000**

Myers, D. R.; Wilcox, S. M.; Marion, W. F.; Al-Abbadi, N. M.; bin Mahfoodh, M.; Mar. 2002; In English; King Abdulaziz City for Science and Technology, Riyadh (Saudi Arabia); Prepared in part by King Abdulaziz City for Science and Technology, Riyadh (Saudi Arabia)

Report No.(s): DE2002-31546; No Copyright; Avail: National Technical Information Service (NTIS)

The Final Report for Annex II - Assessment of Solar Radiation Resources in Saudi Arabia 1998-2000 summarizes the accomplishment of work performed, results achieved, and products produced under Annex II, a project established under the Agreement for Cooperation in the Field of Renewable Energy Research and Development between the Kingdom of Saudi Arabia and the USA. The report covers work and accomplishments from January 1998 to December 2000. A previous progress report, Progress Report for Annex II - Assessment of Solar Radiation Resources in Saudi Arabia 1993-1997, NREL/TP-560-29374, summarizes earlier work and technical transfer of information under the project. The work was performed in at the National Renewable Energy Laboratory (NREL) in Golden, Colorado, at the King Abdulaziz City for Science and Technology (KACST) in Riyadh, Saudi Arabia, and at selected weather stations of the Saudi Meteorological and Environmental Protection Administration (MEPA).

NTIS

*Environment Protection; Renewable Energy; Saudi Arabia; Solar Radiation*

**20020066690** Siemens Solar Industries, Camarillo, CA USA

**Specific PVMaT R&D on Siemens Cz Silicon Product Manufacturing** ***Final Report, Jun. 1998 - Sep. 2001***

Jester, T. L.; Feb. 2002; In English

Report No.(s): DE2002-31581; No Copyright; Avail: National Technical Information Service (NTIS)

This report describes work to improve the cost per watt of Cz modules and to improve PV (photovoltaic) module manufacturing technology. The focus of the three-year program was to implement a 17 % efficient, 195 micron thick cell with a 30 % reduction in manufacturing cost. In addition, the program developed a prototype, 200 mm diameter cell with low cost module packaging. A final result is also a 50 % reduction in slurry use through recycling of silicon carbide, and a 70 % reduction in caustic waste. Work focused on reducing the cost per watt of Cz silicon photovoltaic modules under Siemens Solar Industries' DOE (Department of Energy)/NREL (National Renewable Energy Laboratory) PVMaT (Photovoltaic Manufacturing Technology) 5A2 subcontract is described in this report. Work on cell thickness reduction, the required electrical and mechanical changes to accommodate these thinner cells, larger cells, and waste reduction are all described in this final summary.

NTIS

*Cost Reduction; Manufacturing; Photovoltaic Cells; Renewable Energy; Production Engineering*

**20020066693** National Renewable Energy Lab., Photovoltaics Div., Golden, CO USA

**Thin Film CIGS Photovoltaic Technology** ***Final Report, 16 Apr. 1998 - 15 Oct. 2001***

Delahoy, A. E.; Cambridge, J.; Chen, L.; Kiss, Z. J.; Mar. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-31739; NREL/SR-520-31739; No Copyright; Avail: National Technical Information Service (NTIS)

This report describes the state-of-the-art capabilities that were demonstrated for Mo, CIGS (Cu, In, Ga, Se), and ZnO depositions at coating widths of 45 cm. The CIGS is formed by linear-source evaporation onto moving substrates using multiple line sources. The linear sources were characterized according to deposition uniformity and angular dependence of emitted flux. Uniformity maps were generated for CIGS composition and device performance over large areas. Large-area CIGS modules were produced with Voc's up to 36.9 V. High-Ga-content CIGS devices were produced in the pilot-line system with an efficiency of 11.2% (Voc 596 mV, Jsc 27.4 mA/cm2, FF 67.7%).
NTIS
*Thin Films; Photovoltaic Cells; Crystal Growth; Electrodeposition*

**20020066694** Colorado School of Mines, Golden, CO USA
**Process Development and Basic Studies of Electrochemically Deposited CdTe-Based Solar Cells** ***Final Report, 15 May 1998 - 17 Aug. 2001***
Kaydanov, V. I.; Ohno, T. R.; Mar. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-31777; NREL/SR-520-31777; No Copyright; Avail: National Technical Information Service (NTIS)
This report describes the long-term research and development issues related to polycrystalline thin-film solar cells. Our general research approach is based on combining activities aimed at improvement of cell performance and stability with activities aimed at increasing our fundamental understanding of the properties of materials making up the cells: CdTe, CdS, multi-layer back-contact, and transparent conducting oxide (TCO) front-contact. We emphasize the relation between structural and electronic material properties and various processing procedures, as well as the microscopic mechanisms responsible for the cell performance and its degradation.
NTIS
*Solar Cells; Thin Films; Production Engineering; Electrodeposition*

**20020066697** Barber-Nichols Engineering Co., Arvada, CO USA
**Modular Trough Power Plant Cycle and Systems Analysis**
Price, H.; Hassani, V.; Jan. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-31240; No Copyright; Avail: National Technical Information Service (NTIS)
The objective of this analysis is to reduce the cost of power production from modular concentrating solar power plants through a relatively new and exciting concept that merges two mature technologies to produce distributed modular electric power in the range of 500 to 1,500 kWe. These are the organic Rankine cycle (ORC) power plant and the concentrating solar parabolic (CSP) trough technologies that have been developed independent of each other over many years. Parabolic trough collector technology has been used in large central-station power plants such as the Solar Electric Generating Systems (SEGS) power plants in the California Mojave Desert, which consists of 354 Megawatts (MWe) of installed electric generating capacity. These have been in operation for up to 16 years. ORC air-cooled modular power units have been successfully applied for large- and small-scale geothermal power plants, with more than 600 MWe of capacity, during the same period. The merging of these two technologies to produce distributed modular power plants in the range of 500 to 1500 kilowatt (kWe) offers a new application for both technologies. It is our objective in this report to introduce a modular trough power plant (MTPP) and discuss its performance and the cost of electricity generation from such system.
NTIS
*Electric Power Plants; Solar Energy Conversion; Rankine Cycle; Systems Analysis; Troughs*

**20020066698** Department of Energy, Washington, DC USA
**Small Wind Electric Systems. A North Dakota Consumer's Guide**
2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-31256; No Copyright; Avail: National Technical Information Service (NTIS)
The North Dakota Consumer's Guide for Small Wind Electric systems provides consumers with enough information to help them determine if a small wind electric system can provide all or a portion of the energy they need for their home or business based on their wind resource, energy needs, and their economics. Topics discussed in the guide include: how to make your home more energy efficient, how to choose the right size turbine, the parts of a wind electric system, determining if there is enough wind resource on your site, choosing the best site for your turbine, connecting your system to the utility grid, and if it's possible to

become independent of the utility grid using wind energy. In addition, the North Dakota guide provides state specific information that includes and state wind resource map, state incentives, and state contacts for more information.
NTIS
*Windpower Utilization; North Dakota; Economics; Electric Power*

**20020066699** National Renewable Energy Lab., Golden, CO USA
**Field Verification Project for Small Wind Turbines** ***Quarterly Report, Apr. - Jun. 01***
Apr. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-31271; NREL/TP-500-31271; No Copyright; Avail: National Technical Information Service (NTIS)
This newsletter provides a brief overview of the Field Verification Project for Small Wind Turbines conducted out of the National Wind Technology Center (NWTC) and a description of current activities. The newsletter also contains case studies of current projects.
NTIS
*Wind (Meteorology); Wind Turbines; Performance Tests*

**20020066700** National Park Service, Washington, DC USA
**Inspection and Short-Term Measurement of a National Park Service Photovoltaic/Fuel Cell Remote Hybrid Power System at Kirby Cove, California. Conference Paper**
Walker, A.; Christensen, J.; Rawlings, L.; Feb. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-31321; NREL/CP-710-31321; No Copyright; Avail: National Technical Information Service (NTIS)
This paper reports short-term performance measurements of a hybrid photovoltaic/fuel cell power supply system at Kirby Cove Campground, Golden Gate National Recreation Area, California. The system operated reliably for two years from June 1999 to June 2001. A combination of solar power and power from the fuel cell supplied the campground host power load. In 2001, reports of power outages prompted an investigation. Data are reported for 13.5 days from September 2 to September 15, 2001. Over this time, the photovoltaic array delivered 42.82 kWh, the fuel cell delivered 1.34 kWh, and the net energy from the battery was 6.82 kWh. Photovoltaic efficiency was measured at 8.9%, and fuel cell efficiency at 42%, a typical value. But fuel cell power output was only 35 W, not 250 W, the rated power. Replacing a burnt fuse restored fuel cell power to 125 W, but several cells had low voltage, so the fuel cell was removed for repair or replacement. After the fuel cell failed, loads exceeding the solar capability discharged the batteries; the total for the eight power outages was 48 hours. This paper describes the system's daily operation, presents performance indicators, identifies some causes of performance degradation, and recommends improvements.
NTIS
*Energy Conversion Efficiency; Fuel Cells; National Parks; Photovoltaic Conversion*

**20020066757** National Renewable Energy Lab., Golden, CO USA
**Economic Valuation of a Geothermal Production Tax Credit**
Owens, B.; Apr. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-31969; NREL/TP-620-31969; No Copyright; Avail: National Technical Information Service (NTIS)
The Energy Policy Act of 1992 (EPAct) created a 10-year, inflation-adjusted 1.5 cent per kilowatt-hour (kWh) production tax credit (PTC) for electricity produced from wind and closed loop biomass resources. The Section 45 PTC provides project owners with a credit against taxes for the first 10 years of plant operation. In late 1999, after a brief lapse, the PTC was retroactively extended through December 2001. In 2001, several bills were introduced in the U.S. Senate and House of Representatives which, if passed into law, would set the value of the credit to 1.8 cents/kWh and expand it to include solar, incremental hydropower, and geothermal electric sources. by providing targeted tax incentives, the U.S. government hopes to increase the supply of energy from socially beneficial energy resources. The purpose of this report is to examine the project-level financial impacts of the proposed 10-year 1.8 cent/kWh PTC on geothermal power plants. Within this report, the PTC is compared to the existing Section 48 10% Investment Tax Credit (ITC). The numerical results presented in this report were developed using Geothermal Cost-of-Electricity (GEOCOE), a cost of electricity model developed by the National Renewable Energy Laboratory (NREL). GEOCOE simulates a detailed 30-year nominal dollar cash flow for geothermal power projects including project earnings, cash flows, and debt payment to calculate a project's 15-year levelized cost-of-electricity (LCOE), 15-year after-tax nominal Internal Rate of Return (IRR), and annual Debt-Service-Coverage-Ratios (DSCR).
NTIS
*Geothermal Energy Utilization; Economics; Economic Analysis*

## 45
## ENVIRONMENT POLLUTION

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

**20020065273** Corps of Engineers, Washington, DC USA
**Engineering and Design: Indoor Radon Prevention and Mitigation**
Armstrong, Richard C.; Sep. 15, 1993; 39p; In English
Report No.(s): AD-A403286; ETL-1110-3-438; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This letter provides advance criteria to be used for prevention and mitigation in indoor radon in newly constructed buildings.
DTIC
*Radon; Prevention; Buildings*

**20020065361** Illinois Univ., Dept. of Urban and Regional Planning, Urbana-Champaign, IL USA
**Evaluation of Episodic and Seasonal Emission Controls for Transportation in Illinois** ***Final Report, Dec. 1999 - Aug. 2001***
Jim, T. J.; Lee, J. S.; Crelling, I.; Kang, E.; Jan. 2002; 152p; In English
Report No.(s): PB2002-104399; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche
The Illinois Transportation Research Center, Illinois Department of Transportation commissioned this study to evaluate the cost-effectiveness of episodic and seasonal transportation control measures for ozone in two areas of Illinois. Episodic and seasonal controls target emission reductions when those reductions are most valuable, during an 'ozone episode' and 'ozone season.' Thus, episodic and seasonal control measures are expected to be more cost-effective than most fixed emission control measures, which reduce emissions on a continual basis throughout the year. A nationwide survey was conducted to find the most favorable, politically and economically, existing episodic and seasonal control programs. Based on the survey results, several episodic and seasonal control programs were identified as potentially effective and selected for further analysis. The analysis presented evaluates selected episodic and seasonal control measures for their cost-effectiveness and identifies the most cost-effective episodic and seasonal control measures.
NTIS
*Cost Effectiveness; Evaluation; Transportation; Emission*

**20020065367** Science Applications International Corp., Falls Church, VA USA
**Models-3 Installation Procedures for a Sun Workstation with a UNIX-Based Operation System (Models-3 Version 4.1)**
Benjey, W. G.; May 2001; 216p; In English; See also PB2000-108511
Report No.(s): PB2002-107934; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche
Models-3 is a flexible system designed to simplify the development and use of air quality models and other environmental decision support tools. It is designed for applications ranging from regulatory and policy analysis to understanding the complex interactions of atmospheric chemistry and physics. The May 2001 release of Models-3 contains a Community Multi-scale Air Quality (CMAQ) modeling system for urban to regional scale air quality simulation of tropospheric ozone, acid deposition, visibility, and fine particles. The major improvements in CMAQ since the June 2000 release include the Modified Euler Backward Iterative (MEBI) chemical solver for use with CB4 gas-phase mechanisms, improved horizontal diffusion, and an improved aerosol module. Principal changes to other parts of the Models-3 system improvements include the replacement of the former emission modeling system with provision to use the Sparse Matrix Operator Kernel Emission (SMOKE) modeling system (available at no cost from MCNC, North Carolina Supercomputing Center), and a SMOKE Tool to create input files for SMOKE. This Installation Manual includes an overview of the system architecture, installation requirements, procedures for installation of the Models-3 server and clients, establishing users, Models- 3 start-up and shut-down, loading of data sets, description of system administration functions, and illustrative examples. Release notes describing system changes (including SMOKE Tool) are in Appendices G and H.
NTIS
*Air Quality; Air Pollution; Aerosols; Installing; Computer Programs; Vapor Phases; Atmospheric Physics*

**20020065379** Arizona Univ., Tucson, AZ USA
**Soil Carbon Storage and N2O Emissions from Wheat Agroecosystems as Affected by Free-Air CO2 Enrichment (FACE) and Nitrogen Treatments** ***Final Report***
Leavitt, S. W.; Thompson, A. D.; Rauschkolb, T. L.; Feb. 12, 1999; 16p; In English
Report No.(s): DE2002-765300; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Rising atmospheric CO2 concentrations have prompted concern about response of plants and crops to future elevated CO2 levels, and particularly the extent to which ecosystems will sequester carbon and thus impact the rate of rise of CO2 concentrations. Free-air CO2 enrichment (FACE) experimentation was used with wheat agroecosystems for two growing seasons to assess effects of CO2 and soil nitrogen. Over 20 researchers on this experiment variously examined plant production and grain yield, phenology, length of growing season, water-use efficiency ecosystem production, below ground processes (eg, root and microbial activity, carbon and nitrogen cycling), etc.
NTIS
*Carbon Dioxide; Nitrogen Oxides; Agriculture; Cyclic Hydrocarbons; Soil Sampling; Farm Crops; Atmospheric Composition*

**20020065561** Desert Research Inst., Reno, NV USA
**Control and Adjustment of the Rate of Photosynthesis Above Present CO(2) Levels**
2002; 34p; In English
Report No.(s): DE2002-762794; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The adjustment of photosynthesis to different environmental conditions and especially to elevated CO(sub 2) is often characterized in terms of changes in the processes that establish (limit) the net CO(sub 2) assimilation rate. At slightly above present ambient pCO(sub 2) light-saturated photosynthetic responses to CO(sub 2) depart limitation by the catalytic capacity of tissue rubisco content. An hypothesis attributing this departure to limited thylakoid reaction/electron transport capacity is widely accepted, although we find no experimental evidence in the literature supporting this proposition. The results of several tests point to the conclusion that the capacity of the thylakoid reactions cannot be generally responsible for the deviation from rubisco limitation. This conclusion leaves a significant gap in the interpretation of gas exchange responses to CO(sub 2). Since the inputs to the photosynthetic carbon reduction cycle CO(sub 2) and photon-capture/electron-transport products) do not limit photosynthesis on the shoulder of the A=f(c(sub i)) curve, the control of photosynthesis can be characterized as: due to feedback. Several characteristics of gas exchange and fluorescence that occur when steady-states in this region are perturbed by changes in CO(sub 2) or O(sub 2) suggest significant regulation by conditions other than directly by substrate RuBP levels. A strong candidate to explain these responses is the triose-phosphate flux/inorganic phosphate regulatory sequence, although not all of the gas exchange characteristics expected with 'TPU-limitation' are present (e.g. oxygen-insensitive photosynthesis). Interest in nitrogen allocation between rubisco and light capture/electron transport as the basis for photosynthetic adjustment to elevated CO(sub 2) may need to be reconsidered as a result of these findings. Contributors to the feedback regulation of photosynthesis (which may include sucrose phosphate synthase and fructose bisphosphatase activities, phloem loading, and 'sink-strength') may play a large role in the adjustment of photosynthesis to elevated CO(sub 2). The continuing rise in atmospheric CO(sub 2) elevates the need to understand the regulation of photosynthesis that is not related to rubhsco capacity.
NTIS
*Carbon Cycle; Photosynthesis; Carbon Dioxide; Ecology*

**20020066163** Department of Energy, Washington, DC USA
**Future Energy Conversion Technologies for Heavy Vehicles: Prospects and Promise**
Mar. 26, 2001; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-771148; No Copyright; Avail: National Technical Information Service (NTIS)
The report discusses the Department of Energy, Office of Heavy Vehicle Technologies, whose mission is to conduct, in collaboration with our heavy vehicle industry partners and their suppliers, a customer-focused national program to research and develop technologies that will enable trucks and other heavy vehicles to be more energy efficient and able to use alternative fuels while simultaneously reducing emissions.
NTIS
*Trucks; Research and Development; Motor Vehicles; Energy Conversion*

**20020066300** Environmental Protection Agency, Office of Air and Radiation, Washington, DC USA
**EPA Guidance: Improving Air Quality through Land Use Activities**
Jan. 2001; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): PB2002-107155; EPA/420/R-01/001; No Copyright; Avail: National Technical Information Service (NTIS)
States and communities are interested in accounting for the air quality benefits of their development choices. This guidance presents the conditions under which the benefits of land use activities could be included in air quality and transportation planning processes. The USA Environmental Protection Agency (EPA) intends that this guidance be an additional tool to encourage the development of land use policies and projects which improve liveability in general, and air quality in particular. This effort is intended to complement the efforts of states and local areas, and to provide guidance, flexibility and technical assistance to areas

that wish to implement these measures and use them towards meeting their air quality goals. This guidance document is a non-regulatory interpretation and clarification of EPAs policies and practices relating to treatment of land use activities and is consistent with Section 131 of the Clean Air Act, which states, Nothing in this Act constitutes an infringement on the existing authority of counties and cities to plan or control land use, and nothing in this Act provides or transfers authority over such land use. The goal of this guidance is to assist air quality and transportation planners in accounting for the air quality impacts of land use policies and projects which state and local governments voluntarily adopt. EPA is providing this guidance to give flexibility to state and local governments by expanding the number of strategies an area can use to meet its air quality planning requirements.
NTIS
*Air Quality; Land Use; Environment Protection; Policies*

**20020066301** State Dept., Bureau of Oceans and International Environmental and Scientific Affairs, Washington, DC USA
**U.S. Climate Action Report-2000**
May 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): PB2002-107158; No Copyright; Avail: National Technical Information Service (NTIS)

President Bush reiterated the seriousness of climate change and ordered a Cabinet-level review of U.S. climate change policy. He requested working groups to develop innovative approaches that would: (1) be consistent with the goal of stabilizing greenhouse gas concentrations in the atmosphere; (2) be sufficiently flexible to allow for new findings; (3) support continued economic growth and prosperity; (4) provide market-based incentives; (5) incorporate technological advances; and (6) promote global participation. The President's decision to take a deeper look at climate change policy arose from the recognition that the international dialogue begun to date lacked the requisite participatory breadth for a global response to climate change.
NTIS
*Greenhouse Effect; Policies; Stabilization; Climate Change*

**20020066305** Department of Energy, Washington, DC USA
**Outlook on Mobile Emissions for the 21st Century**
Mar. 2001; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-771149; No Copyright; Avail: National Technical Information Service (NTIS)

The report discusses the Department of Energy, Office of Heavy Vehicle Technologies, whose mission is to conduct, in collaboration with our heavy vehicle industry partners and their suppliers, a customer-focused national program to research and develop technologies that will enable trucks and other heavy vehicles to be more energy efficient and able to use alternative fuels while simultaneously reducing emissions.
NTIS
*Trucks; Research and Development; Air Pollution; Motor Vehicles*

**20020066307** Department of Energy, Washington, DC USA
**Role of Low Sulfur Diesel Fuel in Future Clean Transport Policy**
Mar. 2001; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-771147; No Copyright; Avail: National Technical Information Service (NTIS)

The report discusses the Department of Energy, Office of Heavy Vehicle Technologies, whose mission is to conduct, in collaboration with our heavy vehicle industry partners and their suppliers, a customer-focused national program to research and develop technologies that will enable trucks and other heavy vehicles to be more energy efficient and able to use alternative fuels while simultaneously reducing emissions.
NTIS
*Research and Development; Sulfur; Diesel Fuels; Trucks*

**20020066402** Pennsylvania State Univ., University Park, PA USA
**Overview of the Narsto-Ne-Ops Program**
Philbrick, C. R.; Ryan, W. F.; Clark, R. D.; Doodridge, B. G.; Dickerson, R. R.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-793064; No Copyright; Avail: National Technical Information Service (NTIS)

The NARSTO-NE-OPS (NorthEast Oxidant and Particle Study) is an investigation of the coupling of the meteorological and chemical processes that control the evolution of air pollution events. The project includes three major field programs carried out at a field site in northeast Philadelphia during the summers of 1998, 1999 and 2001. The activity brings together the research groups from 13 universities, 5 government laboratories and representatives of the electric power industry to apply the most

advanced measurement techniques to understanding the physical and chemical processes contributing to air quality issues. Results have been obtained from three ground sites, two instrumented aircraft, many different instrumented balloon platforms, and several remote sensing techniques including satellites. In addition, the database used includes the ground-based measurements conducted at several surrounding state and city operated sites in Pennsylvania, New Jersey, Delaware, New York and Maryland. The results have shown the importance of developing the 3-dimensional regional scale picture of the atmosphere to understand and properly model air pollution events.
NTIS
*Air Pollution; Atmospheric Chemistry; Chemical Reactions; Data Bases*

**20020066406** Florida International Univ., Miami, FL USA
**High Productivity Vacuum Blasting System** ***Final Report***
McPhee, W. S.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-793656; No Copyright; Avail: National Technical Information Service (NTIS)
The Department of Energy (DOE) needs improved technologies to decontaminate large areas of both concrete and steel surfaces. The technology should have high operational efficiency, minimize exposures to workers, and produce low levels of secondary waste. In order to meet the DOE's needs, an applied research and development project for the improvement of a current decontamination technology, Vacuum Blasting, is proposed. The objective of this project is to improve the productivity and lower the expense of the existing vacuum blasting technology which has been widely used in DOE sites for removing radioactive contamination, PCBs, and lead-based paint. The proposed work would increase the productivity rate and provide safe and cost-effective decontamination of the DOE sites.
NTIS
*Air Pollution; Decontamination; Concretes; Surface Finishing; Materials Handling; Vacuum Systems*

**20020066417** Praxair, Inc., Tonawanda, NY USA
**Oxygen Enhanced Combustion for NOx Control** ***Quarterly Report, 1 Oct. - 31 Dec. 2001***
Bool, L. E.; Chen, J. C.; Jan. 2002; 14p; In English
Report No.(s): DE2002-793994; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
This quarterly technical progress report will summarize work accomplished for the Program through the fourth quarter January-March 2001 in the following task areas: Task 1 - Oxygen Enhanced Combustion, Task 2 - Oxygen Transport Membranes (OTM) and Task 4 - Program Management. This report will also recap the results of the past year. The program is proceeding in accordance with the objectives for the first year. OTM material characterization was completed. 100% of commercial target flux was demonstrated with OTM disks. The design and assembly of Praxair's single tube high-pressure test facility was completed. The production of oxygen with a purity of better than 99.5% was demonstrated. Coal combustion testing was conducted at the University of Arizona. Modest oxygen enhancement resulted in NOx emissions reduction. The injector for oxygen enhanced coal based reburning was conducted at Praxair. Combustion modeling with Keystone boiler was completed. Pilot-scale combustion test furnace simulations continued this quarter.
NTIS
*Boilers; Pollution Control; Combustion; Nitrogen Oxides*

**20020066422** United Research Services, Austin, TX USA
**Enhanced Control of Mercury by Wet Flue Gas Desulfurization Systems** ***Final Report***
Botros, P.; Rhudy, R.; Jun. 2001; In English
Report No.(s): DE2002-794238; No Copyright; Avail: National Technical Information Service (NTIS)
The U.S. Department of Energy and EPRI co-funded this project to improve the control of mercury emissions from coal-fired power plants equipped with wet flue gas desulfurization (FGD) systems. The project has investigated catalytic oxidation of vapor-phase elemental mercury to a form that is more effectively captured in wet FGD systems. If successfully developed, the process could be applicable to over 90,000 MW of utility generating capacity with existing FGD systems, and to future FGD installations. Field tests were conducted to determine whether candidate catalyst materials remain active towards mercury oxidation after extended flue gas exposure. Catalyst life will have a large impact on the cost effectiveness of this potential process. A mobile catalyst test unit was used to test the activity of four different catalyst materials for a period of up to six months each at three utility sites. Catalyst testing was completed at the first site, which fires Texas lignite, in December 1998; at the second

test site, which fires a Powder River Basin subbituminous coal, in November 1999; and at the third site, which fires a medium-to high-sulfur bituminous coal, in January 2001.
NTIS
*Desulfurizing; Flue Gases; Fossil Fuels; Mercury (Metal); Pollution Control*

**20020066473** Department of Energy, Office of Heavy Vehicle Technologies, Washington, DC USA
**Outlook on Mobile Emissions for the 21st Century**
May 07, 2001; In English; This document is color dependent and/or in Landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-771153; No Copyright; Avail: National Technical Information Service (NTIS)
This publication discusses the transportation energy consumption in 1997. It also creates transportation options for the 21st century and gives a history of 'promising' alternatives.
NTIS
*Emission; Energy Consumption; Tracks; Exhaust Gases*

**20020066482** Office of Air Quality Planning and Standards, Research Triangle Park, NC USA
**Clean Air Act Confidential Business Information Security Manual**
Jan. 2002; 92p; In English
Report No.(s): PB2002-105421; EPA/450/B-02/001; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
The procedures in this manual provide Federal, Contractor, and Subcontractor employees with the information necessary to utilize Confidential Business Information (CBI) in the performance of their assigned duties without violating applicable Federal regulations protecting the rights of its owners in accordance with the Clean Air Act of 1990 (CAA) as amended.
NTIS
*Commerce; Air Quality; Security; Information Management*

**20020066499** Osmotek, Inc., Corvallis, OR USA
**Cleaner Landfills**
Spinoff 2000; 2000, pp. 53; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.
Osmotek, Inc. developed the Direct Osmosis treatment system through SBIR funding from Ames Research Center. Using technology originally developed for flight aboard the Space Station, the company brought it to their commercial water purification treatment system, Direct Osmosis. This water purification system uses a direct osmosis process followed by a reverse osmosis treatment. Because the product extracts water from a waste product, Osmotek is marketing the unit for use in landfills. The system can treat leachate (toxic chemicals leached into a water source), by filtering the water and leaving behind the leahcate. The leachate then becomes solidified into substance that can not seep into water.
Author
*Technology Utilization; Landfills; Osmosis; Reverse Osmosis; Water Treatment; Waste Management*

**20020066509** Los Alamos National Lab., NM USA
**Mathematical Comparison of Three Tritium System Effluent HTO Cleanup Systems**
Willms, R. S.; Gentile, C.; Rule, K.; Than, C.; Williams, P.; 2002; In English
Report No.(s): DE2002-793804; No Copyright; Avail: National Technical Information Service (NTIS)
It is important that air emissions from tritium systems be kept as low as reasonably achievable. Thus, over the years a number of gas detritiation systems have been developed. Recently there has been interest in lower-cost, simpler systems which do not convert HT to the much more hazardous HTO form. Examples of such systems are: (1) a bubbler/dehumidifier, (2) a bubbler/collector, and (3) an adsorber/collector. A computer model of each configuration was written and run. Each systems performance, including tritium buildup in liquid water, and tritium exhausted to the environment, are presented and compared.
NTIS
*Tritium; Mathematical Models; Computerized Simulation; Emission; Air Flow; Pollution Control; Air Pollution*

**20020066519** NASA Ames Research Center, Moffett Field, CA USA
**Retrieving the Vertical Structure of the Effective Aerosol Complex Index of Refraction from a Combination of Aerosol in Situ and Remote Sensing Measurements During TARFOX**
Redemann, J., Bay Area Environmental Research Inst., USA; Turco, R. P., California Univ., USA; Liou, K. N., California Univ., USA; Russell, P. B., NASA Ames Research Center, USA; Bergstrom, R. W., Bay Area Environmental Research Inst., USA;

Schmid, B., Bay Area Environmental Research Inst., USA; Livingston, J. M., SRI International Corp., USA; Hobbs, P. V., Washington Univ., USA; Hartley, W. S., Washington Univ., USA; Ismail, S., NASA Langley Research Center, USA; Journal of Geophysical Research; Apr. 27, 2000; ISSN 0148-0227; Volume 105, No. D8, pp. 9949-9970; In English
Contract(s)/Grant(s): NCC2-1094
Report No.(s): Paper-1999JD901044; Copyright; Avail: Issuing Activity; Abstract Only

The largest uncertainty in estimates of the effects of atmospheric aerosols on climate stems from uncertainties in the determination of their microphysical properties, including the aerosol complex index of refraction, which in turn determines their optical properties. A novel technique is used to estimate the aerosol complex index of refraction in distinct vertical layers from a combination of aerosol in situ size distribution and remote sensing measurements during the Tropospheric Aerosol Radiative Forcing Observational Experiment (TARFOX). In particular, aerosol backscatter measurements using the NASA Langley LASE (Lidar Atmospheric Sensing Experiment) instrument and in situ aerosol size distribution data are utilized to derive vertical profiles of the 'effective' aerosol complex index of refraction at 815 nm (i.e., the refractive index that would provide the same backscatter signal in a forward calculation on the basis of the measured in situ particle size distributions for homogeneous, spherical aerosols). A sensitivity study shows that this method yields small errors in the retrieved aerosol refractive indices, provided the errors in the lidar derived aerosol backscatter are less than 30% and random in nature. Absolute errors in the estimated aerosol refractive indices are generally less than 0.04 for the real part and can be as much as 0.042 for the imaginary part in the case of a 30% error in the lidar-derived aerosol backscatter. The measurements of aerosol optical depth from the NASA Ames Airborne Tracking Sunphotometer (AATS-6) are successfully incorporated into the new technique and help constrain the retrieved aerosol refractive indices. An application of the technique to two TARFOX case studies yields the occurrence of vertical layers of distinct aerosol refractive indices. Values of the estimated complex aerosol refractive index range from 1.33 to 1.45 for the real part and 0.001 to 0.008 for the imaginary part. The methodology devised in this study provides, for the first time a complete set of vertically resolved aerosol size distribution and refractive index data, yielding the vertical distribution of aerosol optical properties required for the determination of aersol-induced radiative flux changes

Author

*Aerosols; Refractivity; Optical Thickness; In Situ Measurement; Remote Sensing; Atmospheric Sounding; Vertical Distribution*

**20020066544** NASA Ames Research Center, Moffett Field, CA USA

**Wavelength Dependence of the Absorption of Black Carbon Particles: Predictions and Results from the TARFOX Experiment and Implications for the Aerosol Single Scattering Albedo**

Bergstrom, Robert W., Bay Area Environmental Research Inst., USA; Russell, Philip B., NASA Ames Research Center, USA; Hignett, Phillip, Ministry of Defense, UK; Feb. 01, 2002, pp. 567; In English
Contract(s)/Grant(s): NCC2-1094; Copyright; Avail: Issuing Activity; Abstract Only

Measurements are presented of the wavelength dependence of the aerosol absorption coefficient taken during the Tropical Aerosol Radiative Forcing Observational Experiment (TARFOX) over the northern Atlantic. The data show an approximate lamda(exp -1) variation between 0.40 and 1.0 micrometers. The theoretical basis of the wavelength variation of the absorption of solar radiation by elemental carbon [or black carbon (BC)] is explored. For a wavelength independent refractive index the small particle absorption limit simplifies to a lambda(exp -1) variation in relatively good agreement with the data. This result implies that the refractive indices of BC were relatively constant in this wavelength region, in agreement with much of the data on refractive indices of BC. However, the result does not indicate the magnitude of the refractive indices. The implications of the wavelength dependence of BC absorption for the spectral behavior of the aerosol single scattering albedo are discussed. It is shown that the single scattering albedo for a mixture of BC and nonabsorbing material decreases with wavelength in the solar spectrum (i.e., the percentage amount of absorption increases). This decease in the single scattering albedo with wavelength for black carbon mixtures is different from the increase in single scattering allied for most mineral aerosols (dusts). This indicates that, if generally true, the spectral variation of the single- scattering albedo can be used to distinguish aerosol types. It also highlights the importance of measurements of the spectral variation of the aerosol absorption coefficient and single scattering albedo.

Author

*Albedo; Radiation Absorption; Electromagnetic Absorption; Absorptivity; Soot; Atmospheric Scattering; Absorption Spectra*

**20020066548** Sawtek, Inc., Orlando, FL USA

**IMAS: An Intelligent Modular Array System for the Monitoring of VOCs in the Environment: A Technology Reinvestment Program Project *Final Report***

Jul. 1998; 68p; In English
Report No.(s): DE2002-793318; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This yearly technical progress report will summarize work accomplished for Phase 1 Program during the program year 2000/2001. In task 1, the lead material composition was modified to enable superior fluxes and its mechanical properties improved. In task 2, composite OTM elements were fabricated that enable oxygen production at the commercial target purity and 75% of the target flux. In task 3, manufacturing development demonstrated the technology to fabricate an OTM tube of the size required for the multitube tester. The work in task 4 has enabled a preferred composite architecture and process conditions to be predicted. In task 5, the multi-tube reactor is designed and fabrication almost complete.
NTIS
*Volatile Organic Compounds; Arrays; Monitors; Air Pollution*

**20020066553** Research Triangle Inst., Research Triangle Park, NC USA
**Carbon Dioxide Capture from Flue Gas Using Dry Regenerable Sorbents** ***Quarterly Report, 1 Oct. 01 - 31 Dec. 01***
Green, D. A.; Turk, B. S.; Gupta, R. P.; McMichael, W. J.; Harrison, D. P.; Jan. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-793658; No Copyright; Avail: National Technical Information Service (NTIS)
The objective of this project is to develop a simple, inexpensive process to separate CO2 as an essentially pure stream from a fossil fuel combustion system using a regenerable, sodium-based sorbent. The sorbent being used in this project is sodium carbonate which is converted to sodium bicarbonate, or 'baking soda,' through reaction with carbon dioxide and water vapor. Sodium bicarbonate is regenerated to sodium carbonate when heated, producing a nearly pure CO2 stream after condensation of water vapor. This quarter, five cycle thermogravimetric tests were conducted at the Louisiana State University (LSU) with sodium bicarbonate Grade 3 (SBC no. 3) which showed that carbonation activity declined slightly over 5 cycles following severe calcination conditions of 200 degrees C in pure CO2. Three different sets of calcination conditions were tested. Initial carbonation activity (as measured by extent of reaction in the first 25 minutes) was greatest subsequent to calcination at 120 degrees C in He, slightly less subsequent to calcination in 80% CO2/20% H2O, and lowest subsequent to calcination in pure CO2 at 200 degrees C. Differences in the extent of reaction after 150 minutes of carbonation, subsequent to calcination under the same conditions followed the same trend but were less significant. The differences between fractional carbonation under the three calcination conditions declined with increasing cycles.
NTIS
*Carbon Dioxide; Sorbents; Flue Gases; Technology Assessment; Fuel Combustion*

**20020066554** NASA Ames Research Center, Moffett Field, CA USA
**Clear-Sky Closure Studies of Lower Tropospheric Aerosol and Water Vapor During ACE-2 Using Airborne Sunphotometer, Airborne In-Situ, Space-Borne, and Ground-Based Measurements**
Schmid, Beat, Bay Area Environmental Research Inst., USA; Livingston, John M., SRI International Corp., USA; Russell, Philip B., NASA Ames Research Center, USA; Durkee, Philip A., Naval Postgraduate School, USA; Jonsson, Haflidi H., Naval Postgraduate School, USA; Collins, Donald R., California Inst. of Tech., USA; Flagan, Richard C., California Inst. of Tech., USA; Seinfield, John H., California Inst. of Tech., USA; Gasso, Santiago, Washington Univ., USA; Hegg, Dean A., Washington Univ., USA; Tellus; 2000; ISSN 0280-6509; Volume 52B, No. 2, pp. 568-593; In English
Contract(s)/Grant(s): NCC2-1094; Copyright; Avail: Issuing Activity; Abstract Only
We report on clear-sky column closure experiments (CLEARCOLUMN) performed in the Canary Islands during the second Aerosol Characterization Experiment (ACE-2) in June/July 1997. We present CLEARCOLUMN results obtained by combining airborne sunphotometer and in-situ (optical particle counter, nephelometer, and absorption photometer) measurements taken aboard the Pelican aircraft, space-borne NOAA/AVHRR data and ground-based lidar and sunphotometer measurements. During both days discussed here, vertical profiles flown in cloud-free air masses revealed 3 distinctly different layers: a marine boundary layer (MBL) with varying pollution levels, an elevated dust layer, and a very clean layer between the MBL and the dust layer. A key result of this study is the achievement of closure between extinction or layer aerosol optical depth (AOD) computed from continuous in-situ aerosol size-distributions and composition and those measured with the airborne sunphotometer. In the dust, the agreement in layer AOD (lambda = 380-1060 nm) is 3-8%. In the MBL there is a tendency for the in-situ results to be slightly lower than the sunphotometer measurements (10-17% at lambda = 525 nm), but these differences are within the combined error bars of the measurements and computations.
Author
*Absorption Spectroscopy; Aerosols; Particulates; In Situ Measurement; Atmospheric Boundary Layer; Dust; Troposphere; Water Vapor; Photometers; Remote Sensing; Meteorological Satellites; Airborne Equipment; Atmospheric Composition*

**20020066556** NASA Goddard Space Flight Center, Greenbelt, MD USA

**Ground-Based Lidar Measurements of Aerosols During ACE-2: Instrument Description, Results, and Comparisons with Other Ground-Based and Airborne Measurements**

Welton, Ellsworth J., Miami Univ., USA; Voss, Kenneth J., Miami Univ., USA; Gordon, Howard R., Miami Univ., USA; Maring, Hal, Miami Univ., USA; Smirnov, Alexander, NASA Goddard Space Flight Center, USA; Holben, Brent, NASA Goddard Space Flight Center, USA; Schmid, Beat, NASA Ames Research Center, USA; Livingston, John M., NASA Ames Research Center, USA; Russell, Philip B., NASA Ames Research Center, USA; Durkee, Philip A., Naval Postgraduate School, USA; Tellus; 2000; ISSN 0280-6509; Volume 52B, No. 2, pp. 636-651; In English

Contract(s)/Grant(s): NCC2-1094; Copyright; Avail: Issuing Activity; Abstract Only

A micro-pulse lidar system (MPL) was used to measure the vertical and horizontal distribution of aerosols during the Aerosol Characterization Experiment 2 (ACE-2) in June and July of 1997. The MPL measurements were made at the Izana observatory (IZO), a weather station located on a mountain ridge (28 deg 18 min N, 16 deg 30 min W, 2367 m asl) near the center of the island of Tenerife, Canary Islands. The MPL was used to acquire aerosol backscatter, extinction, and optical depth profiles for normal background periods and periods influenced by Saharan dust from North Africa. System tests and calibration procedures are discussed, and an analysis of aerosol optical profiles acquired during ACE-2 is presented. MPL data taken during normal IZO conditions (no dust) showed that upslope aerosols appeared during the day and dissipated at night and that the layers were mostly confined to altitudes a few hundred meters above IZO. MPL data taken during a Saharan dust episode on 17 July showed that peak aerosol extinction values were an order of magnitude greater than molecular scattering over IZO, and that the dust layers extended to 5 km asl. The value of the dust backscatter-extinction ratio was determined to be 0.027 +/- 0.007 sr(exp -1). Comparisons of the MPL data with data from other collocated instruments showed good agreement during the dust episode.

Author

*Optical Radar; Aerosols; Vertical Distribution; Horizontal Distribution; Sahara Desert (Africa); Meteorological Instruments; Radar Measurement*

**20020066558** NASA Ames Research Center, Moffett Field, CA USA

**In Situ Aerosol-Size Distributions and Clear-Column Radiative Closure During ACE-2**

Collins, R., California Inst. of Tech., USA; Jonsson, H. H., Naval Postgraduate School, USA; Seinfeld, J. H., California Inst. of Tech., USA; Flagan, R. C., California Inst. of Tech., USA; Gasso, S., Washington Univ., USA; Hegg, D. A., Washington Univ., USA; Russell, P. B., NASA Ames Research Center, USA; Schmid, B., Bay Area Environmental Research Inst., USA; Livingston, J. M., SRI International Corp., USA; Oestroem, E., Meteorological Office, UK; TELLUS; Sep. 15, 1999; ISSN 0280-6509; Volume 52B, No. 2, pp. 498-525; In English

Contract(s)/Grant(s): NCC2-1094; Copyright; Avail: Issuing Activity; Abstract Only

As part of the second Aerosol Characterization Experiment (ACE-2) during June and July of 1997, aerosol-size distributions were measured on board the CIRPAS Pelican aircraft through the use of a Differential Mobility Analyzer (DMA) and 2 Optical Particle Counters (OPCs). During the campaign, the boundary-layer aerosol typically possessed characteristics representative of a background marine aerosol or a continentally influenced aerosol, while the free-tropospheric aerosol was characterized by the presence or absence of a Saharan dust layer. A range of radiative closure comparisons were made using the data obtained during vertical profiles flown on 4 missions. of particular interest here are the comparisons made between the optical properties as determined through the use of measured aerosol-size distributions and those measured directly by an airborne 14-wavelength sunphotometer and 3 nephelometers. Variations in the relative humidity associated with each of the direct measurements required consideration of the hygroscopic properties of the aerosol for size-distribution-based calculations. Simultaneous comparison with such a wide range of directly-measured optical parameters not only offers evidence of the validity of the physicochemical description of the aerosol when closure is achieved, but also provides insight into potential sources of error when some or all of the comparisons result in disagreement. Agreement between the derived and directly-measured optical properties varied for different measurements and for different cases. Averaged over the 4 case studies, the derived extinction coefficient at 525 nm exceeded that measured by the sunphotometer by 2.5% in the clean boundary layer, but underestimated measurements by 13% during pollution events. For measurements within the free troposphere, the mean derived extinction coefficient was 3.3% and 17% less than that measured by the sunphotometer during dusty and non-dusty conditions, respectively. Likewise, averaged discrepancies between the derived and measured scattering coefficient were -9.6%, +4.7%, +17%, and -41% for measurements within the clean boundary layer, polluted boundary layer, free troposphere with a dust layer, and free troposphere without a dust layer, respectively. Each of these quantities, as well as the majority of the more than 100 individual comparisons from which they were averaged, were within estimated uncertainties.

Author

*In Situ Measurement; Aerosols; Particle Size Distribution; Optical Properties; Atmospheric Boundary Layer; Troposphere; Atmospheric Composition; Atmospheric Sounding*

**20020066561** NASA Ames Research Center, Moffett Field, CA USA

**Shipboard Sunphotometer Measurements of Aerosol Optical Depth Spectra and Columnar Water Vapor During ACE-2, and Comparison with Selected Land, Ship, Aircraft, and Satellite Measurements**

Livingston, John M., SRI International Corp., USA; Kapustin, Vladimir N., Hawaii Univ., USA; Schmid, Beat, Bay Area Environmental Research Inst., USA; Russell, Philip B., NASA Ames Research Center, USA; Quinn, Patricia K., National Oceanic and Atmospheric Administration, USA; Bates, Timothy S., National Oceanic and Atmospheric Administration, USA; Durkee, Philip A., Naval Postgraduate School, USA; Smith, Peter J., Naval Postgraduate School, USA; Freudenthaler, Volker, Ludwig-Maximilians-Univ., Germany; Wiegner, Matthias, Ludwig-Maximilians-Univ., Germany; Tellus; 2000; ISSN 0280-6509; Volume 52B, No. 2, pp. 594-619; In English

Contract(s)/Grant(s): NCC2-1094; Copyright; Avail: Issuing Activity; Abstract Only

Analyses of aerosol optical depth (AOD) and columnar water vapor (CWV) measurements acquired with NASA Ames Research Center's six-channel Airborne Tracking Sunphotometer (AATS-6) operated aboard the R/V (research vehicle) Professor Vodyanitskiy during the second Aerosol Characterization Experiment (ACE-2) are discussed. Data are compared with various in situ and remote measurements for selected cases. The focus is on 10 July, when the Pelican airplane flew within 70 km of the ship near the time of a NOAA (National Oceanographic and Atmospheric Administration)-14/AVHRR (Advanced Very High Resolution Radiometer) satellite overpass and AOD measurements with the 14-channel Ames Airborne Tracking Sunphotometer (AATS-14) above the marine boundary layer (MBL) permitted calculation of AOD within the MBL from the AATS-6 measurements. A detailed column closure test is performed for MBL AOD on 10 July by comparing the AATS-6 MBL AODs with corresponding values calculated by combining shipboard particle size distribution measurements with models of hygroscopic growth and radiosonde humidity profiles (plus assumptions on the vertical profile of the dry particle size distribution and composition). Large differences (30-80% in the mid-visible) between measured and reconstructed AODs are obtained, in large part because of the high sensitivity of the closure methodology to hygroscopic growth models, which vary considerably and have not been validated over the necessary range of particle size/composition distributions. The wavelength dependence of AATS-6 AODs is compared with the corresponding dependence of aerosol extinction calculated from shipboard measurements of aerosol size distribution and of total scattering measured by a shipboard integrating nephelometer for several days. Results are highly variable, illustrating further the great difficulty of deriving column values from point measurements. AATS-6 CWV values are shown to agree well with corresponding values derived from radiosonde measurements during eight soundings on seven days and also with values calculated from measurements taken on 10 July with the AATS-14 and the University of Washington Passive Humidigraph aboard the Pelican.

Author

*Aerosols; Optical Thickness; Atmospheric Moisture; Air Water Interactions; Spectrophotometers; Atmospheric Boundary Layer*

**20020066579** Eastern Research Group, Inc., Morrisville, NC USA

**Nonmethane Organic Compounds (NMOC) and Speciated Nonmethane Organic Compounds (SNMOC) Monitoring Program, 2000** ***Annual Report***

Presnell, V.; Nizich, S.; Apr. 2001; 124p; In English

Report No.(s): PB2002-107924; EPA/454/R-02/001; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This report summarizes and interprets ambient air monitoring data collected during the summer of 2000 as part of the National Nonmethane Organic Compound and Speciated Nonmethane Organic Compound Monitoring Program, which is also called the NMOC/SNMOC Monitoring Program. Designed to characterize levels of air pollution in regions with groundlevel ozone problems, the NMOC/SNMOC Monitoring Program measures air concentrations of several groups of pollutants that participate in the photochemical reactions that form 'smog.' The 2000 NMOC/SNMOC Monitoring Program spanned four months (June to September), during which ambient air samples were collected daily between 6:00 a.m. and 9:00 a.m., local time, at three monitoring locations. These samples were analyzed for NMOC and SNMOC. Overall, over 5000 ambient air concentrations were measured during the 2000 program. This report uses various graphical, numerical, and statistical analyses to identify and illustrate meaningful trends and patterns in this large volume of ambient air monitoring data.

NTIS

*Air Sampling; Data; Cities*

**20020066589** Slott (Robert S.), Hyannis, MA USA

**Remote Sensing Measurement of Real World Vehicle High-Exhaust Emitters** ***Interim Report***

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

Report No.(s): PB2002-107793; No Copyright; Avail: National Technical Information Service (NTIS)

Contents include the following: Executive summary; Scope and Objective; Background; Interim results (E-23 Data, Analysis, How do fleet emissions change from year to year); Future; Summary; Results; Introduction; Background; Objectives; Remote sensing measurements; Vehicle emissions and emissions distributions; Analysis of vehicle emissions; Valid readings; Use of remote sensing measurements; Multi-site remote sensing measurements: Year to year and site to site consistency; Appendix A: Status of E-23 on August 1, 2001; Appendix B: E-23 Measurement Procedures.
NTIS
*Remote Sensing; Air Pollution; Exhaust Emission; Chemical Analysis; Exhaust Gases; Vehicles*

**20020066593** NASA Ames Research Center, Moffett Field, CA USA
**Dependence of Aerosol Light Absorption and Single-Scattering Albedo On Ambient Relative Humidity for Sulfate Aerosols with Black Carbon Cores**
Redemann, Jens, Bay Area Environmental Research Inst., USA; Russell, Philip B., NASA Ames Research Center, USA; Hamill, Patrick, San Jose State Univ., USA; Journal of Geophysical Research; Nov. 16, 2001; ISSN 0148-0227; Volume 106, No. D21, pp. 27,485-27,495; In English
Contract(s)/Grant(s): NCC2-1094
Report No.(s): Paper-2001JD900231; Copyright; Avail: Issuing Activity; Abstract Only

Atmospheric aerosols frequently contain hygroscopic sulfate species and black carbon (soot) inclusions. In this paper we report results of a modeling study to determine the change in aerosol absorption due to increases in ambient relative humidity (RH), for three common sulfate species, assuming that the soot mass fraction is present as a single concentric core within each particle. Because of the lack of detailed knowledge about various input parameters to models describing internally mixed aerosol particle optics, we focus on results that were aimed at determining the maximum effect that particle humidification may have on aerosol light absorption. In the wavelength range from 450 to 750 nm, maximum absorption humidification factors (ratio of wet to 'dry=30% RH' absorption) for single aerosol particles are found to be as large as 1.75 when the RH changes from 30 to 99.5%. Upon lesser humidification from 30 to 80% RH, absorption humidification for single particles is only as much as 1.2, even for the most favorable combination of initial ('dry') soot mass fraction and particle size. Integrated over monomodal lognormal particle size distributions, maximum absorption humidification factors range between 1.07 and 1.15 for humidification from 30 to 80% and between 1.1 and 1.35 for humidification from 30 to 95% RH for all species considered. The largest humidification factors at a wavelength of 450 nm are obtained for 'dry' particle size distributions that peak at a radius of 0.05 microns, while the absorption humidification factors at 700 nm are largest for 'dry' size distributions that are dominated by particles in the radius range of 0.06 to 0.08 microns. Single-scattering albedo estimates at ambient conditions are often based on absorption measurements at low RH (approx. 30%) and the assumption that aerosol absorption does not change upon humidification (i.e., absorption humidification equal to unity). Our modeling study suggests that this assumption alone can introduce absolute errors in estimates of the midvisible single-scattering albedo of up to 0.05 for realistic dry particle size distributions. Our study also indicates that this error increases with increasing wavelength. The potential errors in aerosol single-scattering albedo derived here are comparable in magnitude and in addition to uncertainties in single-scattering albedo estimates that are based on measurements of aerosol light absorption and scattering.
Author
*Aerosols; Humidity; Sulfates; Moisture Content; Electromagnetic Absorption; Atmospheric Models; Albedo; Soot; Light Scattering*

**20020066595** NASA Ames Research Center, Moffett Field, CA USA
**Influence of Humidity On the Aerosol Scattering Coefficient and Its Effect on the Upwelling Radiance During ACE-2**
Gasso, S., Washington Univ., USA; Hegg, D. A., Washington Univ., USA; Covert, D. S., Washington Univ., USA; Collins, D., California Inst. of Tech., USA; Noone, K. J., Stockholm Univ., Sweden; Oestroem, E., Stockholm Univ., Sweden; Schmid, B., Bay Area Environmental Research Inst., USA; Russell, P. B., NASA Ames Research Center, USA; Livingston, J. M., SRI International Corp., USA; Durkee, P. A., Naval Postgraduate School, USA; Tellus; 2000; ISSN 0280-6509; Volume 52B, No. 2, pp. 546-567; In English
Contract(s)/Grant(s): NCC2-1094; Copyright; Avail: Issuing Activity; Abstract Only

Aerosol scattering coefficients (sigma(sub sp)) have been measured over the ocean at different relative humidities (RH) as a function of altitude in the region surrounding the Canary Islands during the Second Aerosol Characterization Experiment (ACE-2) in June and July 1997. The data were collected by the University of Washington passive humidigraph (UWPH) mounted on the Pelican research aircraft. Concurrently, particle size distributions, absorption coefficients and aerosol optical depth were measured throughout 17 flights. A parameterization of sigma(sub sp) as a function of RH was utilized to assess the impact of aerosol hydration on the upwelling radiance (normalized to the solar constant and cosine of zenith angle). The top of the

atmosphere radiance signal was simulated at wavelengths corresponding to visible and near-infrared bands of the EOS (Earth Observing System) AM-1 (Terra) detectors, MODIS (Moderate Resolution Imaging Spectroradiometer) and MISR (Multi-angle Imaging Spectroradiometer). The UWPH measured sigma(sub sp) at two RHs, one below and the other above ambient conditions. Ambient sigma(sub sp) was obtained by interpolation of these two measurements. The data were stratified in terms of three types of aerosols: Saharan dust, clean marine (marine boundary layer background) and polluted marine aerosols (i.e., two- or one-day old polluted aerosols advected from Europe). An empirical relation for the dependence of sigma(sub sp) on RH, defined by sigma(sub sp)(RH) = k.(1 - RH/100)(sup gamma), was used with the hygroscopic exponent gamma derived from the data. The following gamma values were obtained for the 3 aerosol types: gamma(dust) = 0.23 +/- 0.05, gamma(clean marine) = 0.69 +/- 0.06 and gamma(polluted marine) = 0.57 +/- 0.06. Based on the measured gammas, the above equation was utilized to derive aerosol models with different hygroscopicities. The satellite simulation signal code 6S was used to compute the upwelling radiance corresponding to each of those aerosol models at several ambient humidities. For the prelaunch estimated precision of the sensors and the assumed viewing geometry of the instrument, the simulations suggest that the spectral and angular dependence of the reflectance measured by MISR is not sufficient to distinguish aerosol models with various different combinations of values for dry composition, gamma and ambient RH. A similar behavior is observed for MODIS at visible wavelengths. However, the 2100 nm band of MODIS appears to be able to differentiate between at least same aerosol models with different aerosol hygroscopicity given the MODIS calibration error requirements. This result suggests the possibility of retrieval of aerosol hygroscopicity by MODIS.
Author
*Humidity; Aerosols; Scattering Coefficients; Particle Size Distribution; Absorptivity; Optical Thickness; Atmospheric Scattering; Atmospheric Radiation*

**20020066596** NASA Ames Research Center, Moffett Field, CA USA
**Regional Aerosol Optical Depth Characteristics from Satellite Observations: ACE-1, TARFOX and ACE-2 Results**
Durkee, P. A., Naval Postgraduate School, USA; Nielsen, K. E., Naval Postgraduate School, USA; Smith, P. J., Naval Postgraduate School, USA; Russell, P. B., NASA Ames Research Center, USA; Schmid, B., Bay Area Environmental Research Inst., USA; Livingston, J. M., SRI International Corp., USA; Holben, B. N., NASA Goddard Space Flight Center, USA; Tomasi, C., Istituto di Fisica dell Atmosfera, Italy; Vitale, V., Istituto di Fisica dell Atmosfera, Italy; Collins, D., California Inst. of Tech., USA; Tellus; Sep. 06, 1999; ISSN 0280-6509; Volume 52B, No. 2, pp. 484-497; In English
Contract(s)/Grant(s): NCC2-1094; Copyright; Avail: Issuing Activity; Abstract Only
Analysis of the aerosol properties during 3 recent international field campaigns ACE-1, TARFOX and ACE-2 are described using satellite retrievals from NOAA AVHRR data. Validation of the satellite retrieval procedure is performed with airborne, shipboard, and land-based sunphotometry during ACE-2. The intercomparison between satellite and surface optical depths has a correlation coefficient of 0.93 for 630 nm wavelength and 0.92 for 860 nm wavelength, The standard error of estimate is 0.025 for 630 nm wavelength and 0.023 for 860 nm wavelength. Regional aerosol properties are examined in composite analysis of aerosol optical properties from the ACE-1, TARFOX and ACE-2 regions. ACE-1 and ACE-2 regions have strong modes in the distribution of optical depth around 0.1, but the ACE-2 tails toward higher values yielding an average of 0.16 consistent with pollution and dust aerosol intrusions. The TARFOX region has a noticeable mode of 0.2, but has significant spread of aerosol optical depth values consistent with the varied continental aerosol constituents off the eastern North American Coast.
Author
*Photometry; Aerosols; Optical Thickness; Troposphere; Satellite Observation; Remote Sensing*

**20020066597** NASA Langley Research Center, Hampton, VA USA
**Comparison of Aerosol Optical Properties and Water Vapor Among Ground and Airborne Lidars and Sun Photometers During TARFOX**
Ferrare, R., NASA Langley Research Center, USA; Ismail, S., NASA Langley Research Center, USA; Browell, E., NASA Langley Research Center, USA; Brackett, V., Science Applications International Corp., USA; Clayton, M., NASA Langley Research Center, USA; Kooi, S., Science Applications International Corp., USA; Melfi, S. H., Maryland Univ. Baltimore County, USA; Whiteman, D., NASA Goddard Space Flight Center, USA; Schwemmer, G., NASA Goddard Space Flight Center, USA; Evans, K., Maryland Univ. Baltimore County, USA; Journal of Geophysical Research; Apr. 27, 2000; ISSN 0148-0227; Volume 105, No. D8, pp. 9917-9933; In English
Contract(s)/Grant(s): NCC2-1094
Report No.(s): Paper-1999JD901202; Copyright; Avail: Issuing Activity; Abstract Only
We compare aerosol optical thickness (AOT) and precipitable water vapor (PWV) measurements derived from ground and airborne lidars and sun photometers during the Tropospheric Aerosol Radiative Forcing Observational Experiment. Such

comparisons are important to verify the consistency between various remote sensing measurements before employing them in any assessment of the impact of aerosols on the global radiation balance. Total scattering ratio and extinction profiles measured by the ground-based NASA Goddard Space Flight Center scanning Raman lidar system, which operated from Wallops Island, Virginia (37.86 deg N, 75.51 deg W); are compared with those measured by the Lidar Atmospheric Sensing Experiment (LASE) airborne lidar system aboard the NASA ER-2 aircraft. Bias and root-mean-square differences indicate that these measurements generally agreed within about 10%. Aerosol extinction profiles and estimates of AOT are derived from both lidar measurements using a value for the aerosol extinction/backscattering ratio S(sub a) = 60 sr for the aerosol extinction/backscattering ratio, which was determined from the Raman lidar measurements. The lidar measurements of AOT are found to be generally within 25% of the AOT measured by the NASA Ames Airborne Tracking Sun Photometer (AATS-6). However, during certain periods the lidar and Sun photometer measurements of AOT differed significantly, possibly because of variations in the aerosol physical characteristics (e.g., size, composition) which affect S(sub a). Estimates of PWV, derived from water vapor mixing ratio profiles measured by LASE, are within 5-10% of PWV derived from the airborne Sun photometer. Aerosol extinction profiles measured by both lidars show that aerosols were generally concentrated in the lowest 2-3 km.
Author
*Aerosols; Optical Properties; Optical Radar; Photometers; Optical Thickness; Atmospheric Moisture; Atmospheric Scattering*

**20020066625** Department of Energy, Office of Heavy Vehicle Technologies, Washington, DC USA
**Additional Combustion and Emission Control Projects, Heavy Truck Engine Program and Performance Measures for the Engines Team**
Singh, G.; Apr. 12, 2000; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-771160; No Copyright; Avail: National Technical Information Service (NTIS)
Office of Heavy Vehicle Technologies (OHVT) Mission Is to conduct, in collaboration with its heavy vehicle industry partners and their suppliers, a customer-focused national program to research and develop technologies that will enable trucks and other heavy vehicles to be more energy efficient and able to use alternative fuels while simultaneously reducing emissions.
NTIS
*Energy Policy; Trucks; Combustion Chambers; Exhaust Emission*

**20020066626** Southwest Research Inst., San Antonio, TX USA
**Advanced Emission Reduction Technologies for Locomotives: Emissions Testing**
Fritz, S. G.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-771161; No Copyright; Avail: National Technical Information Service (NTIS)
The report includes test procedures based on EPA protocols for certification testing of on-highway and nonroad diesel engines and detailed test procedures published by EPA in US code of federal regulations (CFR), title 40, part 92.
NTIS
*Exhaust Emission; Locomotives; Technologies*

**20020066667** Nevada Univ. System, Atmospheric Sciences Center, Reno, NV USA
**Emissions from Diesel and Gasoline Engines Measured in Highway Tunnels, Part 1, Real-World Particulate Matter and Gaseous Emissions from Motor Vehicles in a Highway Tunnel. Part 2: Airborne Carbonyls from Motor Vehicle Emissions in Two Highway Tunnels**
Gertler, A. W.; Gillies, J. A.; Pierson, W. R.; Rogers, C. F.; Sagebiel, J. C.; Jan. 2002; 110p; In English
Report No.(s): PB2002-108207; HEI-RR-107-01-Pt-1; Copyright; Avail: National Technical Information Service (NTIS), Microfiche
Studies link atmospheric particulate matter (PM) with human health problems. In many urban areas, mobile sources are a major source of PM and the dominant source of fine particles or PM 2.5. Information about particle emission rates, size distributions, and chemical composition from in-use light-duty (LD) gasoline and heavy-duty (HD) diesel vehicles is scarce. to characterize particulate emission from in-use vehicles, we studied emissions from vehicles operating under hot-stabilized conditions, at relatively constant speed, in the Tuscarora Mountain Tunnel along the Pennsylvania Turnpike. Comparing the results of this study with our 1992 results, we found that emission of C8 to C20 hydrocarbons, carbon monoxide (CO), and carbon dioxide (CO2) from HD diesel emissions substantially decreased. Particulate mass emissions showed a similar trend. We observed a continued downward trend in HD particulate emissions from approximately 1,100 mg/km in 1974 to 132 mg/km (reported as PM2.5) in this study. The LD particle emission factor was considerably less than the HD value, but given the large fraction of LD

vehicles, emissions from this source cannot be ignored. Results of this study also indicate that HD and LD vehicles emit ultrafine particles and that they are preserved under real-world dilution conditions. These particles appear to be primarily composed of sulfur, indicative of sulfuric acid emission and nucleation. Comparing the 1992 and 1999 HD oxides of nitrogen (NO-x) emission rates, we observed a 48% increase in emission. This finding supports the assumption that many new-technology diesel engines conserve fuel but increase NO-x emissions.
NTIS
*Air Pollution; Internal Combustion Engines; Exhaust Emission; Automobiles; Exhaust Gases*

**20020066668** West Virginia Univ., Dept. of Mechanical and Aerospace Engineering, Morgantown, WV USA
**Qualification of the Heavy Heavy-Duty Diesel Truck Schedule and Development of Test Procedures** ***Final Report***
Gautam, M.; Clark, N. N.; Wayne, W. S.; Thompson, G.; Lyons, D. W.; Mar. 2002; 150p; In English
Report No.(s): PB2002-108211; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

A test schedule was created by the California Air Resources Board (ARB) to reasonably represent the activity of Heavy Heavy-Duty Diesel Trucks (HHDDT) in the State of California. The HHDDT schedule was based on a statistical replica of data from real world vehicle speed measurements and consisted of four modes; namely, Idle, Creep, Transient and (high speed) Cruise. The objectives of the present study were to examine and validate this schedule and develop associated test procedures. Following recommendations on cycle smoothing and the limitation of deceleration rates, a revised, filtered version of the schedule was prepared. Experimental research on the schedule was conducted using one of the West Virginia University (WVU) Transportable Heavy-Duty Vehicle Testing Laboratories. The four modes were programmed as driver's target traces, and the ability to follow the cycle was determined using both a late model Mack tractor and an older Ford tractor. Speed versus time data for the Mack, obtained on the dynamometer at 25,000, 42,000 and 56,000 lbs simulated test weights, revealed that the weight influenced the ability of the vehicle to follow the trace accurately. Both gear shifting time delays and low power-to-weight ratio caused difficulty in meeting the acceleration rates prescribed in the trace. It was evident that at light test weights, shifting time dominated acceleration delays; but at 56,000 lbs, the vehicle acceleration suffered significantly from loss of power to weight ratio.
NTIS
*Diesel Engines; Exhaust Emission; Trucks; Air Pollution; Pollution Control*

**20020066669** California Univ., Riverside, CA USA
**Chemical Analysis of Diesel Nanoparticles Using a Nano-DMA/Thermal Desorption Particle Beam Mass Spectrometer, Phase 2** ***Final Report***
Ziemann, P. J.; Sakuri, H.; McMurry, P. H.; Apr. 2002; 100p; In English
Report No.(s): PB2002-108212; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

The primary activities of Phase 2 involved two studies of diesel nanoparticles carried out at UMN's (University of Minnesota) Center for Diesel Research; one on a Caterpillar engine and the other on a Cummins engine. The studies were performed in approximately November 2000 and July 2001, respectively. The engines were operated on an EPA Pump fuel (360 ppm S), California fuel (50 and 96 ppm S), and Fischer-Tropsch fuel (less than 1 ppm S), and at different engines loads. The measurements included Nano-DMA (Differential Mobility Analyzer) / TDPBMS (Thermal Desorption Particle Beam Mass Spectrometer) analysis of particle composition similar to those performed in Phase 1, as well as tandem differential mobility analyses of particle volatility and hygroscopicity (i.e., water uptake). Preliminary TDMA (Tandem Differential Mobility Analyzer) measurements were made in the Caterpillar study, followed by an extensive set of measurements in the Cummins study. The data analysis for both studies has been completed, and this document represents the final report on the results.
NTIS
*Diesel Engines; Exhaust Emission; Particulates; Mass Spectrometers; Chemical Analysis*

**20020066670** Office of Air Quality Planning and Standards, Research Triangle Park, NC USA
**RACT/BACT/LAER Clearinghouse Clean Air Technology Center** ***Annual Report, 2001***
Mar. 2002; In English
Report No.(s): PB2002-108216; EPA/456-R-02/001; No Copyright; Avail: CASI; C01, CD-ROM

This RBLC (RACT (Reasonably Available Control Technology) / BACT (Best Available Control Technology) / LAER (Lowest Achievable Emission Rate) Clearinghouse) annual report contains information on the 320 permits entered and modified into the Clearinghouse from January 2001 to December 2001 and provides an overview of data entry activity over the last five years. It summarizes this activity in terms of EPA (Environmental Protection Agency) Regions, States, and industrial processes;

discusses trends over the past five years; and presents plans for additions and improvements to the clearinghouse. More detailed information is contained in the appendices.
NTIS
*Air Pollution; Pollution Control; Air Quality*

**20020066676** NASA Langley Research Center, Hampton, VA USA
**Case Studies of the Vertical Structure of the Direct Shortwave Aerosol Radiative Forcing During TARFOX**
Redemann, J., Bay Area Environmental Research Inst., USA; Turco, R. P., California Univ., USA; Liou, K. N., California Univ., USA; Hobbs, P. V., Washington Univ., USA; Hartley, W. S., Washington Univ., USA; Bergstrom, R. W., Bay Area Environmental Research Inst., USA; Browell, E. V., NASA Langley Research Center, USA; Russell, P. B., NASA Ames Research Center, USA; Journal of Geophysical Research; Apr. 27, 2000; ISSN 0148-0227; Volume 105, No. D8, pp. 9971-9979; In English
Contract(s)/Grant(s): NCC2-1094
Report No.(s): Paper-1999JD901042; Copyright; Avail: Issuing Activity; Abstract Only

The vertical structure of aerosol-induced radiative flux changes in the Earth's troposphere affects local heating rates and thereby convective processes, the formation and lifetime of clouds, and hence the distribution of chemical constituents. We present observationally based estimates of the vertical structure of direct shortwave aerosol radiative forcing for two case studies from the Tropospheric Aerosol Radiative Forcing Observational Experiment (TARFOX) which took place on the U.S. east coast in July 1996. The aerosol radiative forcings are computed using the Fu-Liou broadband radiative transfer model. The aerosol optical properties used in the radiative transfer simulations are calculated from independent vertically resolved estimates of the complex aerosol indices of refraction in two to three distinct vertical layers, using profiles of in situ particle size distributions measured aboard the University of Washington research aircraft. Aerosol single-scattering albedos at 450 nm thus determined range from 0.9 to 0.985, while the asymmetry factor varies from 0.6 to 0.8. The instantaneous shortwave aerosol radiative forcings derived from the optical properties of the aerosols are of the order of -36 Wm(exp -2) at the top of the atmosphere and about -56 Wm(exp -2) at the surface for both case studies.
Author
*Optical Properties; Aerosols; Troposphere; Vertical Distribution; Radiant Flux Density; Radiative Transfer*

**20020066677** NASA Ames Research Center, Moffett Field, CA USA
**Comparison of Aerosol Single Scattering Albedos Derived by Diverse Techniques In Two North Atlantic Experiments**
Russell, P. B., NASA Ames Research Center, USA; Redemann, J., Bay Area Environmental Research Inst., USA; Schmid, B., Bay Area Environmental Research Inst., USA; Bergstrom, R. W., Bay Area Environmental Research Inst., USA; Livingston, J. M., SRI International Corp., USA; McIntosh, D. M., Symtech Corp., USA; Ramirez, S. A., Symtech Corp., USA; Hartley, S., Washington Univ., USA; Hobbs, P. V., Washington Univ., USA; Quinn, P. K., National Oceanic and Atmospheric Administration, USA; Feb. 01, 2002, pp. 609; In English
Contract(s)/Grant(s): NCC2-1094; Copyright; Avail: Issuing Activity; Abstract Only

Aerosol single scattering albedo omega (the ratio of scattering to extinction) is important in determining aerosol climatic effects, in explaining relationships between calculated and measured radiative fluxes, and in retrieving aerosol optical depths from satellite radiances. Recently, two experiments in the North Atlantic region, the Tropospheric Aerosol Radiative Forcing Observational Experiment (TARFOX) and the Second Aerosol Characterization Experiment (ACE-2), determined aerosol omega by a variety of techniques. The techniques included fitting of calculated to measured radiative fluxes; retrievals of omega from skylight radiances; best fits of complex refractive index to profiles of backscatter extinction, and size distribution; and in situ measurements of scattering and absorption at the surface and aloft. Both TARFOX and ACE-2 found a fairly wide range of values for omega at midvisable wavelengths approx. 550 nm, with omega(sub midvis) greater than or equal to 0.85 and less than or equal to 0.99 for the marine aerosol impacted by continental pollution. Frequency distributions of omega could usually be approximated by lognormals in omega(sub max) - omega, with some occurrence of bimodality, suggesting the influence of different aerosol sources or processing. In both TARFOX and ACE-2, closure tests between measured and calculated radiative fluxes yielded best-fit values of omega(sub midvis) 0.90 +/- 0.04 for the polluted boundary layer. Although these results have the virtue of describing the column aerosol unperturbed by sampling, they are subject to questions about representativeness and other uncertainties (e.g., thermal offsets, unknown gas absorption) The other techniques gave larger values for omega(sub midvis) for the polluted boundary layer, with a typical result of omega(sub midvis) = 0.95 +/- 0.04. Current uncertainties in omega are large in terms of climate effects More tests are needed of the consistency among different methods and of humidification effects on omega.
Author
*Aerosols; Tropospheric Scattering; Albedo; Optical Thickness; Radiance; Light (Visible Radiation); Air Sampling*

**20020066680** Environmental Protection Agency, Research Triangle Park, NC USA

**US EPA Models-3/CMAQ: Status and Applications**

Schere, K.; 1999; 8p; In English

Report No.(s): PB2002-107935; EPA/600/B-99/002; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

An advanced third-generation air quality modeling system has been developed by the Atmospheric Modeling Division of the U.S. EPA (Environmental Protection Agency). The air quality simulation model at the heart of the system is known as the Community Multiscale Air Quality (CMAQ) Model. It is comprehensive in scope and allows for the simulation of ozone and photochemical oxidants, acid deposition, and fine and coarse particles at spatial scales ranging from urban to regional. The model is contained within a computational framework, Models-3 (for third generation), that enables users to interact with the modeling system through a high-level graphical user interface and also facilitates data transmission among the components of the system and provides for analysis, graphics, and visualization capabilities for model simulations results.

NTIS

*Air Quality; Air Pollution; Environment Models*

**20020066684** National Inst. of Standards and Technology, Gaithersburg, MD USA

**Isotopic (14C) and Chemical Composition of Atmospheric Volatile Organic Compound Fractions-Precursors to Ozone Formation *Final Report***

Klouda, G. A.; Lewis, C. W.; Rasmussen, R. A.; Stiles, D. C.; Ellenson, W. D.; Oct. 1999; 12p; In English

Report No.(s): PB2002-106741; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Atmospheric volatile organic compounds (VOCs) are an important factor in the production of ozone near ground level (3). Many hydrocarbons originate from auto exhaust. However, a number of VOCs, e.g., isoprene, are known to be natural in origin. to develop reliable models for understanding how ozone levels might be controlled, it has been recognized that a key variable is the fractional amount of fossil vs non-fossil (biogenic, uncontrollable) VOCs (1). These two source categories are uniquely discriminated from each other based on the 14C abundance of VOC fractions. Combining isotopic measurements with chemical information will yield greater confidence in source estimates. Over the last 8 years, NIST, OGI and the U.S. EPA have explored sampling methods and analytical procedures to collect enough carbon from atmospheric non-methane VOC fractions to measure the 14C composition (4, 9). In doing so, this work also provided an opportunity to enhance the sensitivity of GC-FID and GC-MS for chemical identification and quantification. This paper will briefly describe the methods studied and present preliminary 14C and chemical results from Azusa, CA, Houston, TX, and Nashville, TN, USA.

NTIS

*Ozone; Exhaust Emission; Volatile Organic Compounds*

**20020066685** Environmental Protection Agency, Air Pollution Prevention and Control Div., Research Triangle Park, NC USA

**Importance of a Successful Quality Assurance (QA) Program from a Research Manager's Perspective**

Ponder, W. H.; Mar. 2002; 12p

Report No.(s): PB2002-106744; EPA/600/A-02/065; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The paper discusses the Air Pollution Prevention and Control Division's Quality Assurance (QA) program and the approaches used to meet QA requirements in the Division. The presentation is a technical manager's perspective of the Division's requirements for and approach to QA in its research programs. The presentation will include the design of the QA Team, the roles of members of the QA Team, training and technical aids provided by the QA Team to promote understanding of and adherence to Agency QA requirements, the interactions of the QA Team members with principal investigators, and examples of effective conflict resolution.

NTIS

*Environmental Engineering; Quality Control; Assessments; Research Management*

**20020066691** National Renewable Energy Lab., Golden, CO USA
**Diesel Emissions Control-Sulfur Effects Project (DECSE). Summary of Reports**
Feb. 2002; In English; King Abdulaziz City for Science and Technology, Riyadh (Saudi Arabia)
Report No.(s): DE2002-31600; NREL/TP-540-31600; No Copyright; Avail: National Technical Information Service (NTIS)
This summary describes a government and industry cost-shared project to determine the impact of fuel sulfur levels on emission control systems that could be used to lower emissions of nitrogen oxides and particulate matter.
NTIS
*Diesel Engines; Exhaust Emission; Pollution Control; Exhaust Gases*

**20020066752** California Inst. of Tech., Division of Geological and Planetary Sciences, Pasadena, CA USA
**Study of Tropospheric Ozone and UV Reflectivity Using TOMS Data** ***Final Report, 1 Jan. 2001 - 31 May 2002***
Yung, Yuk L., California Inst. of Tech., USA; [2002]; 4p; In English
Contract(s)/Grant(s): NAG5-7230; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
Perhaps the single most important result from the study of Chuang and Yung is that the interannual variability of the Earth's albedo (especially in Spring) on land is dominated by snow/ice, and not by clouds. This interannual variability could be the major driver of changes in the atmosphere and the biosphere. It is plausible that the interannual variability of snow/ice, through interactions with the atmosphere and biosphere, is responsible for the interannual variability of atmospheric CO2. by carefully studying the albedo variations off the Peru coast, we found evidence for indirect aerosol effect on clouds. Based on a detailed analysis of the cloud data obtained by the International Satellite Cloud Climatology Project (SCCP) in the years 1983-1991, we show that besides the reported 3 % variation in global cloudiness, the global mean cloud optical thickness (MCOT) also has significant variation which is out of phase with that of the global cloudiness. The combined effect of the two opposing variations may be a null effect on the cloud reflectivity. These results are consistent with the Total Ozone Mapping Spectrometer (TOMS) reflectively measurements. The MCOT variation is further shown to be correlated with both the solar cycle and the ENSO (El Nino Southern Oscillation) cycle. Our present analysis cannot distinguish which of the above two provides better correlation, although independent data from the High resolution Infrared Radiation Sounder (HIRS) from 1990 to 1996 favor the solar cycle. Future data are needed to identify the true cause of these changes.
Derived from text
*Reflectance; Ozone; Troposphere; Total Ozone Mapping Spectrometer; Ultraviolet Radiation; Clouds (Meteorology); Atmospheric Composition*

**20020066756** Argonne National Lab., Decision and Information Sciences Div., IL USA
**When and How to End Shelter-In-Place Protection from a Release of Airborne Hazardous Material: Report on a Decision-Making Concept and Methodology**
Jul. 30, 2001; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-41773; No Copyright; Avail: National Technical Information Service (NTIS)
Shelter-in-place (SIP) is considered a credible alternative to immediate evacuation to protect the population on and around Army chemical warfare agent stockpile storage sites from accidental agent releases of short duration. to be effective, this strategy requires immediate SIP to minimize initial exposure to agent vapor, followed by timely and appropriate termination of SIP to minimize additional exposure to agent vapor accumulations in the shelter when the air outside becomes less hazardous. However, a major challenge facing emergency managers has been how to decide the best time and way to end SIP to obtain this ideal. This report describes a concept to make this decision, and suggests a methodology to apply the concept as a site-specific response tool.
NTIS
*Hazardous Materials; Shelters; Storage Stability; Environmental Engineering; Chemical Warfare; Military Operations*

**20020066760** Department of Energy, Washington, DC USA
**Diesel Emissions Control-Sulfur Effects (DECSE) Program Status**
Jun. 29, 1999; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-771171; No Copyright; Avail: National Technical Information Service (NTIS)
The objective of the program is to determine the impact of fuel sulfur levels on emission control systems that could be implemented to lower emissions of NO(sub x) and PM from on-highway trucks in the 2002-2004 time frame.
NTIS
*Air Pollution; Diesel Engines; Sulfur; Pollution Control*

## 46
## GEOPHYSICS

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

**20020065467** Washington Univ., Polar Science Center, Seattle, WA USA
**Toward Construction of an Efficient, Lead-Resolving PIPS Model** ***Final Report, 1 May 1999-30 Jun. 2002***
Zhang, Jinlun; Jun. 25, 2002; 7p; In English; Original contains color images
Contract(s)/Grant(s): N00014-99-1-0742
Report No.(s): AD-A403568; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Developed an ADI method to efficiently solve the ice momentum equations associated with a lead-based viscous plastic rheology. Implemented the ADI solver in a dynamic thermodynamic sea-ice model in spherical coordinates. Also developed mathematical formulations for viscous plastic rheologies using teardrop and parabolic lens yield curves with or without incorporating tensile stress. These rheologies, together with the elliptical yield curve, have been numerically implemented in a 10 km. high-resolution 12 category thickness and enthalpy distribution (TED) model for the Arctic Ocean. Did three model runs with these 3 yield curves, driven by atmospheric forcing from 1987-1999. Conducted model runs with a corresponding 40 km resolution model using 4 plastic yield curves. Incorporated an optimal interpolation data assimilation procedure in a TED sea-ice model. Investigated effects of assimilating buoy drift data and satellite ice motion data on modeling Arctic sea ice.
DTIC
*Ice; Alternating Direction Implicit Methods; Dynamic Models; Rheology*

**20020066416** Institute of Gas Technology, Des Plaines, IL USA
**Capacitive Tomography for the Location of Plastic Pipe** ***Quarterly Report, 1 Oct. - 31 Dec. 01***
Huber, B. J.; Jan. 25, 2002; 22p; In English
Report No.(s): DE2002-793997; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Throughout the utility industry, there is high interest in subsurface imaging of plastic, ceramic, and metallic objects because of the cost, reliability, and safety benefits available in avoiding impacts with the existing infrastructure and in reducing inappropriate excavations. Industry interest in locating plastic pipe has resulted in funding available for the development of technologies that enable this imaging. Gas Technology Institute (GTI) proposes to develop a compact and inexpensive capacitive tomography imaging sensor that takes the form of a flat plate or flexible mat that can be placed on the ground to image objects embedded in the soil. A compact, low-cost sensor that can image objects through soil could be applied to multiple operations and will produce a number of cost savings for the gas industry. In a stand-alone mode, it could be used to survey an area prior to excavation. The technology would improve the accuracy and reliability of any operation that involves excavation by locating or avoiding buried objects. An accurate subsurface image of an area will enable less costly keyhole excavations and other cost-saving techniques. Ground penetrating radar (GPR) has been applied to this area with limited success. Radar requires a high-frequency carrier to be injected into the soil: the higher the frequency, the greater the image resolution. Unfortunately, high-frequency radio waves are more readily absorbed by soil. Also, high-frequency operation raises the cost of the associated electronics. by contrast, the capacitive tomography sensor uses low frequencies with a multiple-element antenna to obtain better resolution. Low-frequency operation lowers the cost of the associated electronics while improving depth of penetration. The objective of this project is to combine several existing techniques in the area of capacitive sensing to quickly produce a demonstrable prototype. The sensor itself will take the form of a flat array of electrodes that can be inexpensively fabricated using printed circuit board techniques. The image resolution is proportional to the number and spacing of the electrodes in the array. Measuring the complex impedance between adjacent electrodes at multiple frequencies forms the image. Simple location of plastic pipe with a two-electrode array has already been demonstrated. Twelve months will be required to produce a prototype imaging system consisting of a flat sensor that can be laid on the ground to scan the volume immediately beneath it. Following a successful demonstration of this prototype, the application of this sensor to the surface of a backhoe will be addressed.
NTIS
*Pipelines; Plastics*

**20020066438** NASA Goddard Space Flight Center, Greenbelt, MD USA
**Deuterium and Oxygen Toward Feige 110: Results from the Far Ultraviolet Spectroscopic Explorer (FUSE) Mission**
Friedman, S. D., Johns Hopkins Univ., USA; Howk, J. C., Johns Hopkins Univ., USA; Chayer, P., Johns Hopkins Univ., USA; Tripp, T. M., Princeton Univ. Observatory, USA; Hebrard, G., Institut d'Astrophysique, France; Andre, M., Johns Hopkins Univ., USA; Oliveira, C., Johns Hopkins Univ., USA; Jenkins, E. B., Princeton Univ. Observatory, USA; Moos, H. W., Johns Hopkins

Univ., USA; Oegerle, William R., NASA Goddard Space Flight Center, USA; [2001]; 24p; In English
Contract(s)/Grant(s): NAS5-32985; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present measurements of the column densities of interstellar D I and O I made with the Far Ultraviolet Spectroscopic Explorer (FUSE), and of H I made with the International Ultraviolet Explorer (IUE) toward the sdOB star Feige 110 [(l,b) = (74.09 deg., - 59.07 deg.); d = 179(sup +265, sub -67) pc; Z = -154(sup +57, Sub -227 pc). Our determination of the D I column density made use of curve of growth fitting and profile fitting analyses, while our O I column density determination used only curve of growth techniques. The H I column density was estimated by fitting the damping wings of the interstellar Ly(lpha) profile. We find log N(D I) = 15.47 +/- 0.06, log N(O I) = 16.73 +/- 0.10, and log N(H I) = 20.14(sup +0.13, sub -0.20) (all errors 2(sigma)). This implies D/H = (2.14 +/- 0.82) x 10(esp -5), D/O = (5.50(sup + 1.64, sub -133)) x 10(exp -2), and O/H = (3.89 +/- 1.67) x 10(exp -4). Taken with the FUSE results reported in companion papers and previous measurements of the local interstellar medium, this suggests the possibility of spatial variability in D/H for sight lines exceeding approx. 100 pc. This result may constrain models which characterize the mixing time and length scales of material in the local interstellar medium.
Author
*Deuterium; Oxygen; Far UV Spectroscopic Explorer; Interstellar Matter; Density Measurement*

**20020066460** NASA Goddard Space Flight Center, Greenbelt, MD USA
**Abundances of Deuterium, Oxygen and Nitrogen in the Local Interstellar Medium: Overview of First Results from the Far Ultraviolet Spectroscopic Explorer Mission**
Moos, H. W., Johns Hopkins Univ., USA; Sembach, K. R., Johns Hopkins Univ., USA; Vidal-Madjar, A., Institut d'Astrophysique, France; York, D. G., Chicago Univ., USA; Friedman, S. D., Johns Hopkins Univ., USA; Hebrard, G., Institut d'Astrophysique, France; Kruk, J. W., Johns Hopkins Univ., USA; Lehner, N., Johns Hopkins Univ., USA; Lemoine, M., Institut d'Astrophysique, France; Sonneborn, G., NASA Goddard Space Flight Center, USA; [2002]; 56p; In English
Contract(s)/Grant(s): NAS5-32985; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Observations obtained with the Far Ultraviolet Spectroscopic Explorer (FUSE) have been used to determine the column densities of D I, O I, and N I along seven sight lines that probe the local interstellar medium (LISM) at distances from 37 pc to 179 pc. Five of the sight lines are within the Local Bubble and two penetrate the surrounding H I wall. Reliable values of N(H I) were determined for five of the sight lines from HST data, IUE data, and published EUVE measurements. The weighted mean of DI/H I for these five sight lines is (1.52 +/- 0.08) x l0(exp -5)(1 sigma uncertainty in the mean). It is likely that the D I/H I ratio in the Local Bubble has a single value. The D I/O I ratio for the five sight lines within the Local Bubble is (3.76 +/- 0.20) x 10(esp -2). It is likely that O I column densities can serve as a proxy for H I in the Local Bubble. The weighted mean for O I/ H I for the seven FUSE sight lines is (3.03 +/- 0.21) x 10(esp -4), comparable to the weighted mean (3.43 +/- 0.15) x 10(exp -4) reported for 13 sight lines probing larger distances and higher column densities. The FUSE weighted mean of N I/ H I for five sight lines is half that reported by Meyer et al. for seven sight lines with larger distances and higher column densities. This result combined with the variability of O I/ N I (six sight lines) indicates that at the low column densities found in the LISM, nitrogen ionization balance is important. Thus, unlike O I, N I cannot be used as a proxy for H I or as a metallicity indicator in the LISM.
Author
*Deuterium; Oxygen; Nitrogen; Interstellar Matter*

**20020066611** California Univ., Lawrence Berkeley National Lab., Berkeley, CA USA
**Effects of Dry Fractures on Matrix Diffusion in Unsaturated Fractured Rocks**
Seol, Y.; Liu, H. H.; Bodvarsson, G. S.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-793765; No Copyright; Avail: National Technical Information Service (NTIS)

Matrix diffusion has been recognized as an important mechanism affecting solute transport through unsaturated fractured rock, where a significant fraction of the fracture network remains relatively dry and inactive in conducting liquid flow. This simulation study shows that dry fractures act as strong diffusion barriers to solute transport when such fractures divide the matrix into discrete blocks. Where fracture surface roughness causes some regions of direct contact between matrix blocks separated by a dry fracture, the contacts of the matrix blocks provide conduits for liquid flow and molecular diffusion across dry fractures. Simulation results indicate that the presence of dry fractures and their discontinuities considerably affect solute transport in unsaturated fractured rocks.
NTIS
*Fractures (Materials); Geological Faults; Simulation; Molecular Diffusion*

**20020066648** NASA Goddard Space Flight Center, Greenbelt, MD USA

**The Effects of Implementing TopModel Concepts in the Noah Model**

Peters-Lidard, C. D., NASA Goddard Space Flight Center, USA; [2002]; 4p; In English; AMS 16th Conference on Hydrology, 14-17 Jan. 2002, Orlando, FL, USA; Sponsored by American Meteorological Society, USA

Contract(s)/Grant(s): 40AANR0A4107; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Topographic effects on runoff generation have been documented observationally (e.g., Dunne and Black, 1970) and are the subject of the physically based rainfall-runoff model TOPMODEL (Beven and Kirkby, 1979; Beven, 1986a;b) and its extensions, which incorporate variable soil transmissivity effects (Sivapalan et al, 1987, Wood et al., 1988; 1990). These effects have been shown to exert significant control over the spatial distribution of runoff, soil moisture and evapotranspiration, and by extension, the latent and sensible heat fluxes

Derived from text

*Topography; Hydrology Models; Soil Moisture; Latent Heat; Evapotranspiration; Heat Flux*

**20020066781** NASA Goddard Space Flight Center, Greenbelt, MD USA

**The X-Ray Structure and Spectrum of the Pulsar Wind Nebula Surrounding PSR B1853+01 in W44**

Petre, R., NASA Goddard Space Flight Center, USA; Kuntz, K. D., NASA Goddard Space Flight Center, USA; Shelton, R. L., Johns Hopkins Univ., USA; [2001]; 10p; In English

Contract(s)/Grant(s): NAS8-39073; G01-2057A; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We present the result of a Chandra ACIS observation of the pulsar PSR B1853+01 and its associated pulsar wind nebula (PWN), embedded within the supernova remnant W44. A hard band ACIS map cleanly distinguishes the PWN from the thermal emission of W44. The nebula is extended in the north-south direction, with an extent about half that of the radio emission. Morphological differences between the X-ray and radio images are apparent. Spectral fitting reveals a clear difference in spectral index between the hard emission from PSR B1853+01 (Gamma approx. 1.4) and the extended nebula (Gamma approx. 2.2). The more accurate values for the X-ray flux and spectral index are used refine estimates for PWN parameters, including magnetic field strength, the average Lorentz factor gamma of the particles in the wind, the magnetization parameter sigma, and the ratio k of electrons to other particles.

Author

*X Ray Spectra; Pulsars; Nebulae; Data Acquisition; Supernova Remnants*

**20020066791** Rice Univ., Dept. of Physics and Astronomy, Houston, TX USA

**Comprehensive Quantitative Model of Inner-Magnetosphere Dynamics** ***Final Report, 1 Feb. 1999 - 30 Apr. 2002***

Wolf, Richard A., Rice Univ., USA; [2002]; 9p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAG5-8136; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This report includes descriptions of papers, a thesis, and works still in progress which cover observations of space weather in the Earth's magnetosphere. The topics discussed include: 1) modelling of magnetosphere activity; 2) magnetic storms; 3) high energy electrons; and 4) plasmas.

CASI

*Earth Magnetosphere; Astronomical Models; Electrodynamics; Reports; Magnetic Storms; High Energy Electrons; Inner Radiation Belt*

**20020067409** NASA Goddard Space Flight Center, Greenbelt, MD USA

**Migration of Matter from the Edgeworth-Kuiper and Main Asteroid Belts to the Earth**

Ipatov. S. I., NASA Goddard Space Flight Center, USA; [2002]; 8p; In English; Dust in the Solar System and Other Planetary Systems, 10-14 Apr. 2000, Canterbury, UK; Sponsored by International Astronomical Union, Unknown

Contract(s)/Grant(s): NAG5-10776; INTAS 00-240; RFBR 01-01-17540; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The main asteroid belt (MAB), the Edgeworth-Kuiper belt (EKB), and comets belong to the main sources of dust in the Solar System. Most of Jupiter-family comets came from the EKB. Comets can be distracted due to close encounters with planets and the Sun, collisions with small bodies, a nd internal forces. We support the Eneev's idea that the largest objects in the ELB and MAB could be formed directly by the compression of rarefied dust condensations of the protoplanetary cloud but not by the accretion of small (for example, 1-km) planetesimals. The total mass of planetesimals that entered the EKB from the feeding zone of the giant planets during their accumulation could exceed tens of Earth's masses. These planetesimals increased eccentricities of 'local' trans-Neptunian objects (TNOs) and swept most of these TNOs. A small portion of such planetesimals could left beyond

Neptune's orbit in highly eccentric orbits. The results of previous investigations of migration and collisional evolution of minor bodies were summarized. Mainly our recent results are presented.
Author
*Asteroid Belts; Dust; Eccentric Orbits; Kuiper Belt; Migration*

**20020067579** NASA Goddard Space Flight Center, Greenbelt, MD USA
**Mesospheric Temperature Structure during the GUARA Campaign and Comparison with the DROPPS and MaCWAVE Campaigns**
Schmidlin, F. J., NASA Goddard Space Flight Center, USA; Goldberg, R. A., NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; COSPAR Meeting, 10-19 Oct. 2002, Houston, TX, USA; Sponsored by Committee on Space Research, Unknown; No Copyright; Avail: Issuing Activity; Abstract Only

A significant number of passive inflatable falling spheres launched from Alcantara, Brazil (2S) during the MALTED campaign in August 1994 showed unusual temperature layering at 70 and 85 km, Reprocessing of the original radar position data reveal more consistent temperature inversions over time than was observed during the DROPPS campaign conducted from northern Scandinavia during July 1999. Comparison between falling sphere measurements and the HALOE instrument on UARS provides a now perspective about the atmospheric structure at two widely separated locations. The availability of NASA and Brazilian C-band radars established high confidence in the data quality during MALTED. A new campaign, MaCWAVE scheduled this summer from Andoys, Rocket Range, Norway (67N) will provide characteristics of gravity wave activity that will be compared with the MALTED temperature and wind profiles.
Author
*Temperature Inversions; Mesosphere; Atmospheric Temperature; Falling Spheres; Microwave Frequencies*

**20020067635** NASA Goddard Space Flight Center, Greenbelt, MD USA
**NASA/GSFC Scanning Raman Lidar Measurements of Water Vapor and Cirrus Clouds during WVIOP2000 and AFWEX**
Whiteman, D. N., NASA Goddard Space Flight Center, USA; Evans, K. D., Maryland Univ. Baltimore County, USA; DiGirolamo, P., University of Basilicata, Italy; Demoz, B. B., Maryland Univ. Baltimore County, USA; Turner, D., Pacific Northwest National Lab., USA; Comstock, J., Pacific Northwest National Lab., USA; Ismail, S., NASA Langley Research Center, USA; Ferrare, R. A., NASA Langley Research Center, USA; Browell, E. V., NASA Langley Research Center, USA; Goldsmith, J. E. M., Sandia National Labs., USA; [2002]; 1p; In English; 2002 Atmospheric Radiation Measurement (ARM) Science Team Meeting, 8-12 Apr. 2002, Saint Petersburg, FL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The NASA/GSFC Scanning Raman Lidar (SRL) was deployed to the Southern Great Plains CART site from September - December, 2000 and participated in two field campaigns devoted to comparisons of various water vapor measurement technologies and calibrations. These campaigns were the Water Vapor Intensive Operations Period 2000 (WVIOP2000) and the ARM FIRE Water Vapor Experiment (AFWEX). WVIOP2000 was devoted to validating water vapor measurements in the lower atmosphere while AFWEX had similar goals but for measurements in the upper troposphere. The SRL was significantly upgraded both optically and electronically prior to these field campaigns. These upgrades enabled the SRL to demonstrate the highest resolution lidar measurements of water vapor ever acquired during the nighttime and the highest S/N Raman lidar measurements of water vapor in the daytime; more than a factor of 2 increase in S/N versus the DOE CARL Raman Lidar. Examples of these new measurement capabilities along with comparisons of SRL and CARL, LASE, MPI-DIAL, in-situ sensors, radiosonde, and others will be presented. The profile comparisons of the SRL and CARL have revealed what appears to be an overlap correction or countrate correction problem in CARL. This may be involved in an overall dry bias in the precipitable water calibration of CARL with respect to the MWR of approx. 4%. Preliminary analysis indicates that the application of a temperature dependent correction to the narrowband Raman lidar measurements of water vapor improves the lidar/Vaisala radiosonde comparisons of upper tropospheric water vapor. Other results including the comparison of the first-ever simultaneous measurements from four water vapor lidar systems, a bore-wave event captured at high resolution by the SRL and cirrus cloud optical depth studies using the SRL and CARL will be presented at the meeting.
Author
*Optical Radar; Water Vapor; Deployment; Radar Measurement*

**20020067636** Maryland Univ. Baltimore County, Goddard Earth Sciences and Technology Center, Catonsville, MD USA

**Sensitivity of Middle Atmospheric Analyses to the Representation of Gravity-Wave Drag in the DAO's Data Assimilation System**

Li, Shuhua, NASA Goddard Space Flight Center, USA; Chern, Jiundar, NASA Goddard Space Flight Center, USA; Joiner, Joanna, NASA Goddard Space Flight Center, USA; Lin, Shian-Jiann, NASA Goddard Space Flight Center, USA; Pawson, Steven, NASA Goddard Space Flight Center, USA; daSilva, Arlindo, NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; Spring AGU Meeting, 28-31 May 2002, Washington, DC, USA; Sponsored by American Geophysical Union, USA

Contract(s)/Grant(s): NCC5-494; No Copyright; Avail: Issuing Activity; Abstract Only

The damping of mesoscale gravity waves has important effects on the global circulation, structure, and composition of the atmosphere. A number of assimilation and forecast experiments have been conducted to examine the sensitivity of meteorological analyses and forecasts to the representation of gravity wave impacts in a data assimilation system (DAS). The experiments were conducted with the Finite-Volume (FV) DAS developed at NASA's Data Assimilation Office (DAO), The main purpose of this research is to determine the optimal combination of wave number, phase speed, wavelength, etc. for representing gravity-wave drag (GWD) in FVDAS. The GWD included in FVDAS includes a spectrum of waves, as would be forced by topography and transient motions (e.g., convection) in the troposphere. The sensitivity experiments are performed by modifying several parameters, such as the number of waves allowed, their wavelength, the background stress amplitude, etc. The results show that the assimilated fields are very sensitive to the number of gravity waves represented in the system, especially at high latitudes of the middle and upper stratosphere and mesosphere in winter. The analyzed stratopause temperature varies by up to 10K when the GWD scheme is modified from a multiple-wave scheme (using a stationary wave and waves with phase speeds of 10, 20, 30 and 40 m/s in each direction) to a single, stationary wave. Insight into the reality of the various versions of the GWD can be obtained by examining the "Observation minus Forecast" residuals from the FVDAS.

Author

*Damping; Mesoscale Phenomena; Wave Drag; Sensitivity Analysis; Forecasting*

**20020067643** NASA Goddard Space Flight Center, Greenbelt, MD USA

**Global Modeling Activities and NAME**

Schubert, Siegfried, NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; 5th Session of the CLIVAR/VAMOS Meeting, 13-16 Mar. 2002, San Jose, Costa Rica; No Copyright; Avail: Issuing Activity; Abstract Only

In this talk I will review global modeling activities in the United States that could contribute to and benefit from NAME activities. I will present some preliminary results from several global atmospheric general circulation model simulation experiments for the initial NAME model intercomparison project period of May-Oct 1990. These include an ensemble of medium resolution simulations, and a high resolution (one half degree) simulation. I will also discuss possible high resolution global data assimilation experiments that could be used to help validate the model simulations and assimilate planned NAME observations.

Author

*Atmospheric General Circulation Models; High Resolution; Assimilation; Atmospheric Circulation*

## 47
## METEOROLOGY AND CLIMATOLOGY

*Includes weather observation forecasting and modification*

**20020065341** Air Force Weather Agency, Offutt AFB, NE USA

**Summer Regimes**

Weber, Eugene M.; Mar. 15, 2001; 67p; In English; Original contains color images; See also non-print CD-ROM, AD-M001399

Report No.(s): AD-A403439; AFWA/TN-01/001; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This technical note presents a back-to-basics approach to forecasting the weaker, slower moving weather systems of summer. It is especially designed for new and inexperienced forecasters, but it is also an excellent review for all forecasters. As summer approaches, the subtropical ridge begins to drift northward across the southern USA. The increasing insolation, moisture, and weakening pressure and thermal gradients require forecasters to apply different forecasting rules. This technical note presents synoptic patterns and regimes that routinely occur during the summer months. Synoptic pattern recognition is still one of the most important considerations when producing a forecast and will help in determining if model guidance is 'on track'.

DTIC

*Summer; Weather Forecasting; Tropical Regions; Synoptic Meteorology*

**20020065440** Lawrence Livermore National Lab., Livermore, CA USA

**ARM-GCSS Intercomparison Study of Single-Column Models and Cloud System Models**

Cederwall, R. T.; Rodriguez, D. J.; Krueger, S. K.; Randall, D. A.; Oct. 27, 1999; 16p; In English

Report No.(s): DE2002-792291; UCRL-133576; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The objectives of the GCSS are to: (1) develop the scientific basis for the parameterization of cloud processes, (2) highlight key issues and encourage other relevant programs to address them, and (3) promote the evaluation and intercomparison of parameterization schemes for cloud processes. There are a variety of cloud processes that affect the large-scale behavior of the climate system, but occur on scales too small to be represented explicitly in global numerical models used for climate and weather prediction. Scientists develop numerical representations or parameterizations to represent the behavior of these processes. It is generally recognized that inadequate parameterization of clouds is one of the greatest sources of uncertainty in the prediction of weather and climate.

NTIS

*Meteorology; Clouds (Meteorology); Weather Forecasting; Parameterization*

**20020065565** NASA Ames Research Center, Moffett Field, CA USA

**Stratospheric Aerosol Measurements**

Pueschel, Rudolf, F., NASA Ames Research Center, USA; [1998]; 1p; In English; Symposium on Advanced Enviornmental Monitoring, 10-14 Sep. 1998, Kwangju, Korea, Republic of

Contract(s)/Grant(s): RTOP 622-65-26-10; No Copyright; Avail: Issuing Activity; Abstract Only

Stratospheric aerosols affect the atmospheric energy balance by scattering and absorbing solar and terrestrial radiation. They also can alter stratospheric chemical cycles by catalyzing heterogeneous reactions which markedly perturb odd nitrogen, chlorine and ozone levels. Aerosol measurements by satellites began in NASA in 1975 with the Stratospheric Aerosol Measurement (SAM) program, to be followed by the Stratospheric Aerosol and Gas Experiment (SAGE) starting in 1979. Both programs employ the solar occultation, or Earth limb extinction, techniques. Major results of these activities include the discovery of polar stratospheric clouds (PSCs) in both hemispheres in winter, illustrations of the impacts of major (El Chichon 1982 and Pinatubo 1991) eruptions, and detection of a negative global trend in lower stratospheric/upper tropospheric aerosol extinction. This latter result can be considered a triumph of successful worldwide sulfur emission controls. The SAGE record will be continued and improved by SAGE III, currently scheduled for multiple launches beginning in 2000 as part of the Earth Observing System (EOS). The satellite program has been supplemented by in situ measurements aboard the ER-2 (20 km ceiling) since 1974, and from the DC-8 (13 km ceiling) aircraft beginning in 1989. Collection by wire impactors and subsequent electron microscopic and X-ray energy-dispersive analyses, and optical particle spectrometry have been the principle techniques. Major findings are: (1) The stratospheric background aerosol consists of dilute sulfuric acid droplets of around 0.1 micrometer modal diameter at concentration of tens to hundreds of monograms per cubic meter; (2) Soot from aircraft amounts to a fraction of one percent of the background total aerosol; (3) Volcanic eruptions perturb the sulfuric acid, but not the soot, aerosol abundance by several orders of magnitude; (4) PSCs contain nitric acid at temperatures below 195K, supporting chemical hypotheses implicating manmade fluorocarbons as cause of the --'ozone hole'; (5) The current soot loading is too small to be of environmental (radiative and chemical) consequence. However, the fractal nature of soot distinguishes it aerodynamically and radiatively from sulfuric acid droplets such that its stratospheric residence time is longer, mainly because of vertical transport against gravity due to gravito-photophoretic forces. Thus it may accumulate and become of environmental concern in the future.

Author

*Aerosols; Satellite-Borne Instruments; Sage Satellite; In Situ Measurement; Stratosphere*

**20020066527** National Weather Service, National Centers for Environmental Prediction, Silver Spring, MD USA

**Rapid Update Cycle, Part 2, Verification and Evaluation**

Morone, L. L.; Pond, S. J.; 2002; 38p; In English

Report No.(s): PB2002-107900; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The RUC is an analysis/forecast data assimilation system developed by the Forecase System Laboratory (FSL) of NOAA's Environmental Research Laboratories (Benjamin, et al. 1994a). The version running at FSL is called the Mesoscale Analysis and Prediction System (MAPS). The objective evaluations consisted of verification against observed data. A simple bilinear interpolation was used to obtain an analyzed or forecast value at the observation's location from model fields on mandatory pressure levels. Separate comparisons were made against rawinsondes and a combined dataset of profiler and automated aircraft reports. Separate mean and standard deviation error statistics were computed from temperature and moisture variables.

NTIS

*Wind (Meteorology); Air Traffic Control; Data Acquisition*

**20020066528** National Oceanic and Atmospheric Administration, Rockville, MD USA

**Probability Forecasts of Clear-Air-Turbulence for the Contiguous U.S**

Reap, R. M.; 2002; 18p; In English

Report No.(s): PB2002-107901; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This bulletin describes the new NGM-based 6-h probability forecasts of nonconvective clear-air-turbulence (CAT) for the contiguous U.S. that have been produced daily in a non-operational mode for the National Centers for Environmental Prediction's (NCEP's) Aviation Weather Center (AWC) and Hydrometeorological Prediction Center (HPC) since August 16, 1995. The new probability forecasts were designed to provide general objective guidance in the 2-26 h timeframe to forecasters at the aviation operations branch of AWC located in Kansas City, MO. AWC is responsible for issuing operational AIRMETS and SIGMETS which are inflight advisories for use by the aviation community.

NTIS

*Clear Air Turbulence; Aviation Meteorology; Weather Forecasting*

**20020066545** NASA Ames Research Center, Moffett Field, CA USA

**The Discrepancy Between Measured and Modeled Downwelling Solar Irradiance at the Ground: Dependence on Water Vapor**

Pilewskie, P., NASA Ames Research Center, USA; Rabbette, M., NASA Ames Research Center, USA; Bergstrom, R., Bay Area Environmental Research Inst., USA; Marquez, J., Massachusetts Inst. of Tech., USA; Schmid, B., Bay Area Environmental Research Inst., USA; Russell, P. B., NASA Ames Research Center, USA; Geophysical Research Letters; Jan. 01, 2000; ISSN 0094-8276; Volume 27, No. 1, pp. 137-140; In English

Contract(s)/Grant(s): NCC2-1094

Report No.(s): Paper-1999GL011085; Copyright; Avail: Issuing Activity; Abstract Only

Moderate resolution spectra of the downwelling solar irradiance at the ground in north central Oklahoma were measured during the Department of Energy Atmospheric Radiation Measurement Program Intensive Observation Period in the fall of 1997. Spectra obtained under cloud-free conditions were compared with calculations using a coarse resolution radiative transfer model to examine the dependency of model-measurement bias on water vapor. It was found that the bias was highly correlated with water vapor and increased at a rate of 9 Wm(exp -2) per cm of water. The source of the discrepancy remains undetermined because of the complex dependencies of other variables, most notably aerosol optical depth, on water vapor.

Author

*Water Vapor; Radiative Transfer; Atmospheric Radiation; Solar Spectra; Atmospheric Moisture; Bias; Mathematical Models; Spectral Correlation*

**20020066555** NASA Ames Research Center, Moffett Field, CA USA

**Comparison of Columnar Water-Vapor Measurements from Solar Transmittance Methods**

Schmid, Beat; Michalsky, J.; Slater, Donald W.; Barnard, James C.; Halthore, Rangasayi N.; Liljegren, James C.; Holben, Brent N.; Eck, Thomas F.; Livingston, John M.; Russell, Philp B.; Applied Optics; Apr. 20, 2001; Volume 40, No. 12; 1p; In English

Contract(s)/Grant(s): NCC2-1094; Copyright; Avail: Issuing Activity; Abstract Only

The Atmospheric Radiation Measurement program studied water vapor abundance measurement at its southern Great Plains site in the fall of 1997. The program used a large number of instruments, including four solar radiometers. By measuring solar transmittance in the 0.94 micrometer water apor absorption band, they were able to measure columnar water vapor (CWV). In the second round of comparison we used the same radiative transfer model, and the same line-by-line code (which includes recently corrected H2O spectroscopy) to retrieve CWV from all four solar radiometers, thus decreasing the mean CWV by 8 - 13 %. The model was not responsible for the 8 % spread in CWV which remained.

CASI

*Radiative Transfer; Transmittance; Atmospheric Radiation; Radiation Measurement; Atmospheric Moisture*

**20020066567** NASA Goddard Space Flight Center, Greenbelt, MD USA

**Impact of Soil Moisture Initialization on Seasonal Weather Prediction**

Koster, Randal D., NASA Goddard Space Flight Center, USA; Suarez, Max J., NASA Goddard Space Flight Center, USA; [2002]; 55p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The potential role of soil moisture initialization in seasonal forecasting is illustrated through ensembles of simulations with the NASA Seasonal-to-Interannual Prediction Project (NSIPP) model. For each boreal summer during 1997-2001, we generated two 16-member ensembles of 3-month simulations. The first, "AMIP-style" ensemble establishes the degree to which a perfect prediction of SSTs would contribute to the seasonal prediction of precipitation and temperature over continents. The second

ensemble is identical to the first, except that the land surface is also initialized with ”realistic” soil moisture contents through the continuous prior application (within GCM simulations leading up to the start of the forecast period) of a daily observational precipitation data set and the associated avoidance of model drift through the scaling of all surface prognostic variables. A comparison of the two ensembles shows that soil moisture initialization has a statistically significant impact on summertime precipitation and temperature over only a handful of continental regions. These regions agree, to first order, with regions that satisfy three conditions: (1) a tendency toward large initial soil moisture anomalies, (2) a strong sensitivity of evaporation to soil moisture, and (3) a strong sensitivity of precipitation to evaporation. The degree to which the initialization improves forecasts relative to observations is mixed, reflecting a critical need for the continued development of model parameterizations and data analysis strategies.
Author
*Weather Forecasting; Soil Moisture; Moisture Content*

**20020066569** Bern Univ., Inst. of Applied Physics, Bern, Switzerland
**Modeled and Empirical Approaches for Retrieving Columnar Water Vapor from Solar Transmittance Measurements in the 0.72, 0.82, and 0.94 Micrometer Absorption Bands**
Ingold, T., Bern Univ., Switzerland; Schmid, B., Bay Area Environmental Research Inst., USA; Maetzler, C., Bern Univ., Switzerland; Demoulin, P., Liege Univ., Belgium; Kaempfer, N., Bern Univ., Switzerland; Journal of Geophysical Research; Dec. 16, 2000; ISSN 0148-0227; Volume 105, No. D19, pp. 24,327-24,343; In English
Contract(s)/Grant(s): NCC2-1094
Report No.(s): Paper-2000JD900392; Copyright; Avail: Issuing Activity; Abstract Only

A Sun photometer (18 channels between 300 and 1024 nm) has been used for measuring the columnar content of atmospheric water vapor (CWV) by solar transmittance measurements in absorption bands with channels centered at 719, 817, and 946 nm. The observable is the band-weighted transmittance function defined by the spectral absorption of water vapor and the spectral features of solar irradiance and system response. The transmittance function is approximated by a three-parameter model. Its parameters are determined from MODTRAN and LBLRTM simulations or empirical approaches using CWV data of a dual-channel microwave radiometer (MWR) or a Fourier transform spectrometer (FTS). Data acquired over a 2-year period during 1996-1998 at two different sites in Switzerland, Bern (560 m above sea level (asl)) and Jungfraujoch (3580 m asl) were compared to MWR, radiosonde (RS), and FTS retrievals. At the low-altitude station with an average CWV amount of 15 mm the LBLRTM approach (based on recently corrected line intensities) leads to negligible biases at 719 and 946 nm if compared to an average of MWR, RS, and GPS retrievals. However, at 817 nm an overestimate of 2.7 to 4.3 mm (18-29%) remains. At the high-altitude station with an average CWV amount of 1.4 mm the LBLRTM approaches overestimate the CWV by 1.0, 1.4. and 0.1 mm (58, 76, and 3%) at 719, 817, and 946 nm, compared to the ITS instrument. At the low-altitude station, CWV estimates, based on empirical approaches, agree with the MWR within 0.4 mm (2.5% of the mean); at the high-altitude site with a factor of 10 less water vapor the agreement of the sun photometers (SPM) with the ITS is 0.0 to 0.2 mm (1 to 9% of the mean CWV there). Sensitivity analyses show that for the conditions met at the two stations with CWV ranging from 0.2 to 30 mm, the retrieval errors are smallest if the 946 nm channel is used.
Author
*Absorption Spectra; Atmospheric Moisture; Solar Radiation; Atmospheric Models; Transmittance; Photometry*

**20020066600** NASA Goddard Space Flight Center, Greenbelt, MD USA
**A Robust Retrieval of Water Vapor Column In Dry Arctic Conditions Using the Rotating Shadowband Spectroradiometer**
Kiedron, P., State Univ. of New York, USA; Michalsky, J., State Univ. of New York, USA; Schmid, B., Bay Area Environmental Research Inst., USA; Slater, D., Pacific Northwest National Lab., USA; Berndt, J., State Univ. of New York, USA; Harrison, L., State Univ. of New York, USA; Racette, P., NASA Goddard Space Flight Center, USA; Westwater, E., Colorado Univ., USA; Han, Y., Colorado Univ., USA; Journal of Geophysical Reserch; Oct. 27, 2001; ISSN 0148-0227; Volume 106, No. D20, pp. 24,007-24,016; In English
Contract(s)/Grant(s): NCC2-1094

Report No.(s): Paper-2000JD000130; Copyright; Avail: Issuing Activity; Abstract Only

A method to retrieve water vapor column using the 940-nm water vapor absorption band in dry Arctic conditions is presented. The retrievals with this method are stable with respect to uncertainties in instrument radiometric calibration, air pressure, solar source function, and aerosols. The water vapor column was retrieved with this method using spectra obtained with the rotating shadowband spectroradiometer (RSS) that was deployed during an intensive observation period near Barrow, Alaska, in March 1999. A line-by-line radiative transfer model was used to compute water vapor transmittance. The retrievals with this method are compared with retrievals obtained from three independent measurements with microwave radiometers. All four measurements show the same pattern of temporal variations. The RSS results agree most closely with retrievals obtained with the millimeter-wave imaging radiometer (MIR) at its 183 GHz +/- 7 double-side band channel. Their correlation over a period of 7 days when water vapor column varied between 0.75 mm and 3.6 mm (according to RSS) is 0.968 with MIR readings 0.12 mm higher on average.

Author

*Water Vapor; Absorption Spectra; Arctic Regions; Spectroradiometers; Atmospheric Composition; Remote Sensing; Atmospheric Moisture; Radiative Transfer*

**20020066746** Arkansas-Red Basin River Forecast Center, Tulsa, OK USA

**Categorical Flood Forecast Verification System for Southern Region RFC River Forecasts**

Corby, R. J.; 2002; In English; This document is color dependent and/or landscape layout. It is currently only available on CD-ROM and in paper copy

Report No.(s): PB2002-107665; No Copyright; Avail: National Technical Information Service (NTIS)

The National Weather Service (NWS) River Forecast (RFC) are responsible for producing flood forecasts for major rivers and streams throughout the country. For some time now, there has been a recognized need for a river forecast verification system to evaluate the RFC's skill in the delivery of this service. The agency cites two goals for verification: (1) Improve accuracy and timeliness of river forecasts and (2) document overall trends in forecast performance (NWS, 2001). Verification of river forecasts at individual locations are required to identify areas where forecast skill requires improvement. Hydrologic development efforts can then be concentrated on areas where an RFC consistently does an inadequate job of forecasting. Accumulating pertinent verification information for an RFC over a period of time, an RFC can show trends in their overall river prediction performance. As technology and science continue to advance, 'improvements' will continue to be made to our hydrologic models and their underlying infrastructure. We are now capable of generating river forecasts quicker and at higher resolution than ever before. Without concrete performance measures, it is difficult to link improvements in river forecast accuracy to technological and scientific changes.

NTIS

*Flood Predictions; Rivers*

**20020067605** NASA Goddard Inst. for Space Studies, New York, NY USA

**The Temperature of the Earth in 2020**

Hansen, James, NASA Goddard Inst. for Space Studies, USA; [2002]; 1p; In English; 34th Scientific Assembly of the Committee on Space Research (COSPAR), 10-19 Oct. 2002, Houston, TX, USA; Sponsored by Committee on Space Research, Unknown; No Copyright; Avail: Issuing Activity; Abstract Only

In spite of the confusion in the public discourse about global warming, there is no doubt that the Earth has been warming for the past century. The chemistry of the Earth's atmosphere is complex, and it is sometimes difficult to claim cause-and-effect with certainty. Nevertheless, the evidence seems clear that CO2 and non-CO2 forcings such as methane and air pollution are causally related to this warming trend. Our dependence on fossil fuels make it difficult to expect that massive reductions in CO2 will be feasible in the near-term, however. In this talk I will consider the evidence for global warming, the extent to which we can extrapolate current trends into the future if no changes in global policy are introduced, and those near-term policies that might be realistically introduced to significantly affect those trends.

Author

*Carbon Dioxide; Earth Atmosphere; Global Warming; Methane*

## 48
## OCEANOGRAPHY

*Includes the physical, chemical and biological aspects of oceans and seas; ocean dynamics, and marine resources. For related information see also 43 Earth Resources and Remote Sensing.*

**20020065526** Physics and Electronics Lab. TNO, The Hague, Netherlands

**Analysis of High Resolution Coherent Polarized Sea Clutter Data at Low Grazing Angles** ***Final Report***

Melief, H. W., Physics and Electronics Lab. TNO, Netherlands; Greidanus, H., Physics and Electronics Lab. TNO, Netherlands; Heemskerk, H. J. M., Physics and Electronics Lab. TNO, Netherlands; April 2002; 98p; In English; Original contains color illustrations

Contract(s)/Grant(s): TNO Proj. 015.28851

Report No.(s): TD00-0489; FEL-01-A216; Copyright; Avail: Issuing Activity

This report presents results of the Netherlands contribution to the ANNCP (Anglo-Netherlands-Norwegian co-operation Program) 1.25 co-operation program. Three sets of low grazing angle X-band radar data, made available by DERA (Defense Evaluation and Research Agency UK), Malvern, were analysed. The data contained sea clutter and three small targets. The data were thoroughly analysed in a number of ways. The Doppler, time and polarimetric behavior of the sea clutter and in particular of sea spikes was studied. Moreover, several simple techniques were used to discriminate the targets from the sea clutter. These analyses gave the following results. Firstly, a number of the characteristics of the ocean surface could be derived, such as the wavelength and the period of the dominant waves, as well as the current. Moreover, Doppler-time diagrams were made of sea spikes, whose characteristics could be linked with the physical properties of breaking wave events. Finally, the sea clutter could be quantitatively described as being composed of two multiplicative processes with different decorrelation times. The simple discrimination techniques revealed that targets could best be distinguished from the clutter by using long integration times as well as polarimetry.

Author

*Radar Data; Clutter; Ocean Surface; Signal Analysis; Target Recognition*

**20020066429** Naval Postgraduate School, Monterey, CA USA

**Examination of the 13 February 2001 Eastern Pacific Maritime Cyclogenesis**

Touchton, Marc E.; Mar. 2002; 63p; In English; Original contains color images

Report No.(s): AD-A403545; No Copyright; Avail: CASI; A04, Hardcopy

On 13 February 2001, an explosive cyclone made landfall in Southern California. This system was responsible for storm force winds and heavy precipitation in the Los Angeles area. This storm is interesting because it was handled poorly by the numerical models and developed in an unusual area. Analysis of this storm revealed double circulation centers and multiple baroclinic zones. Due to weak static stability, air-sea fluxes were contributory in developing the baroclinic zone from which this cyclone originated as well as enhancing its development rate. Evidence suggests that the system may have had a warm core, similar to other intense extratropical cyclones. The models did not properly forecast this system due to weak cold air advection over the Eastern Pacific Ocean and due to blending the subpolar and subtropical jets into a single feature. Data assimilation is suspected to have played a role in the mishandling of these key features.

DTIC

*Air Water Interactions; Marine Meteorology; Cyclones; Ocean Surface; Cyclogenesis; Advection*

**20020066748** National Ocean Service, Rockville, MD USA

**Office of Coast Survey Hydrographic Surveys Division's AWOIS (Automated Wreck and Obstruction Information System) User's Guide**

Feb. 2002; 32p; In English

Report No.(s): PB2002-107929; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In 1981, the National Ocean Service (NOS) implemented the Automated Wreck and Obstruction Information System (AWOIS) to assist in planning hydrographic survey operations and to catalog and store a substantial volume of reported wrecks and obstructions that are considered navigational hazards within U.S. coastal waters. Today, over 10,000 reports have been received, which include unverified accounts of vessel casualties, as well as chronological history. As part of the hydrographic survey planning process, these records are reviewed and those wrecks or obstructions which require additional field investigations

are assigned to specific field units. The results of these investigations eventually become part of the AWOIS file so that a permanent record of a wreck or obstruction is always available.
NTIS
*Barriers; Information Systems; Hydrography*

**20020066749** National Ocean Service, Office of National Marine Sanctuaries, Silver Spring, MD USA
**National Marine Sanctuaries (Trade Name) Pre-Construction Coral Survey WELLWOOD Grounding Site, April 23-24, 2002**
May 09, 2002; 20p; In English
Report No.(s): PB2002-107928; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Surveys conducted between 1984 and 1994 showed that benthic community succession at the grounding site of the M/V Wellwood resulted in a community more like that of nearby hard grounds than the original transition zone assemblage that likely inhabited the location prior to the 1984 incident. Biological assemblages were dominated by a limited number of gorgonian and scleractinian species with high recruitment rates. Gorgonian corals composed most of the cover. Very few framework building hard corals had recruited to the site, and their slow growth precluded the development of pre-existing topographic complexity, a factor vital to continued development of diverse invertebrate and fish assemblages. This survey was conducted to provide information on coral abundance and cover in the area to be restored as well as reference areas nearby. The data establish a pre-construction baseline in these communities and allow scientists and resource managers to track the trajectory of recovery following enhancement. The purpose is to determine whether this restoration will result in a biological assemblage with the character of the transition community that would exist there had the incident not occurred or whether the assemblage continues to develop the character of a hard ground.
NTIS
*Coral Reefs; Surveys; Animals*

## 51
## LIFE SCIENCES (GENERAL)

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

**20020065252** Georgetown Univ., Washington, DC USA
**Molecular Mechanisms of Estrogen and Antiestrogen Resistance** ***Annual Report, 1 Jul. 2000-30 Jun. 2001***
Clarke, Robert R.; Jul. 2001; 102p; In English; Original contains color images
Contract(s)/Grant(s): DAMD17-99-1-9191
Report No.(s): AD-A403335; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This is an Academic (Career Development) Award. Consistent with this award, the PI(Principal Investigator) continues to ".. appraise critically the state of the science in a particular aspect of breast cancer research and to forge new avenues of investigation." In this application, the studies are focused on antiestrogen resistance. With respect to the career development aspects, several original studies and reviews relevant to this application have been published, others have been submitted for publication. We continue to apply state-of-the-art technologies to addressing resistance, including the development of novel approaches to data mining and analysis. The studies of interferon regulatory factor-1 (IRF-l) continue. We have now completed the initial studies of the IRF-l transfected cells and have developed and begun to test a dominant negative IRF-1 construct. Immunohistologic methods for correlative studies on human breast tissues are being developed and we hope soon to study the expression of nucleophosmin, NFkappaB, IkF-1 and X-box binding protein -l (hxBP-l) and any correlations with known prognostic markers. We also have explored the effects of in utero Tamoxifen exposure on mammary gland development and subsequent susceptibility to chemical carcinogenesis. The role of the steroid sulfatase in affecting estrogen dependence in vitro and in vivo also was explored. Data show that overexpression of this enzyme can release sufficient intracellular estrogens to support estrogen-dependent growth.
DTIC
*Cancer; Estrogens*

**20020065253** Kentucky Univ., Research Foundation, Lexington, KY USA

**Dietary Lipids, Cell Adhesion and Breast Cancer Metastasis** ***Annual Report, 1 Oct. 2000-30 Sep. 2001***

Toborek, Michal J.; Oct. 2001; 92p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-99-1-9247

Report No.(s): AD-A403337; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Excessive consumption of dietary fat may enhance the rate of breast cancer metastasis. In addition, it is generally accepted that the upregulation of endothelial cell adhesion molecules is involved in the formation of blood-borne metastasis. Among different adhesion molecules, evidence indicates that intracellular adhesion molecule-1 (ICAM-1) may play a critical role in breast cancer metastatic formation. Our studies have demonstrated that dietary fatty acids can exert highly specific effects on NF-KB activation and expression of adhesion molecules in human endothelial cells. In addition, we indicated that linoleic acid induces ICAM-1 and vascular cell adhesion molecule-1 (VCAM-1) expression through the activation of NF-KB. More importantly, because the ability of cancer cells to interact with the endothelium appears to be a prerequisite for the potential of distant metastasis and because ICAM-1 and VCAM-1 are considered to be a crucial adhesion molecule in this process, the present study may have significant therapeutic implications in developing a novel strategy against cancer metastasis.

DTIC

*Cancer; Metastasis; Diets; Fatty Acids*

**20020065255** Long Island Jewish Medical Center, New Hyde Park, NY USA

**Breast Cancer Prevention by Hormonally Induced Mammary Gland Differentiation: The Role of a Novel Mammary Growth Inhibitor and Differentiation Factor MRG** ***Annual Report, 1 Oct. 2000-30 Sep. 2001***

Shi, Y. E.; Oct. 2001; 16p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-99-1-9255

Report No.(s): AD-A403339; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We have previously identified and characterized a novel tumor growth inhibitor and a fatty acid binding protein in human mammary gland and named it as Mammary derived growth inhibitor Related Gene MRG. MRG has tumor-suppressing activities; it inhibits breast cancer cell growth in vitro and tumor growth in vivo. Here, the MRG expression on mammary gland and the effects of MRG on mammary gland differentiation were investigated. MRG protein expression was associated with human mammary gland differentiation with the highest expression observed in the differentiated alveolar mammary epithelial cells from the lactating gland. Overexpression of MRG in human breast cancer cells induced differentiation with changes in cellular morphology and a significant increase in the production of lipid droplets. Treatment of mouse mammary gland in organ culture with MRG protein resulted in a differentiated morphology and stimulation of beta-casein expression. In vivo studies using MMTV/MRG transgenic model also indicated an increased lobulo- alveoli in the gland from the MRG transgenic mice. Our results suggest that MRG is a candidate mediator of the differentiating effect of pregnancy on breast epithelial cells.

DTIC

*Cancer; Mammary Glands*

**20020065256** Johns Hopkins Univ., School of Medicine, Baltimore, MD USA

**Development of a Diagnostic Blood Test for Breast Cancer** ***Annual Report, 1 Sep. 2000-31 Aug. 2001***

Gabrielson, Edward W.; Sep. 2001; 6p; In English

Contract(s)/Grant(s): DAMD17-99-1-9236

Report No.(s): AD-A403321; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The purpose of this project is to develop and test the feasibility of a diagnostic blood test for breast cancer. Specifically, we are testing the feasibility of detecting breast cancer DNA shed into plasma (or serum) using methylation-specific PCR. In our studies to date, we have shown that large breast cancers shed sufficient quantities of DNA to allow detection using our proposed strategy. We have encountered several unexpected challenges to our expected application of this strategy for clinical application, however. First, many breast cancers do not have methylation of genes that we originally proposed for testing. We have successfully identified other genes that are frequently methylated in breast cancers, however, and will proceed in our project using these markers. A second problem that we have encountered is that the small serum or plasma sample size available does not frequently allow us to test multiple markers as proposed. We are addressing this problem by using a nested PCR approach that will allow us to test multiple markers from a single small sample. Additional ongoing studies will determine the limits of sensitivity for our assay in terms of tumor size and sample volume required.

DTIC

*Deoxyribonucleic Acid; Cancer; Methylation; Diagnosis*

**20020065257** Health Research, Inc., Buffalo, NY USA

**Discovery of DNA Binding Anticancer Drugs That Target Oncogenic Transcription Factors Associated With Human Breast Cancer** ***Annual Report, 15 Sep. 2000-14 Sep 2001***

Beerman, Terry A.; Oct. 2001; 69p; In English

Contract(s)/Grant(s): DAMD17-99-1-9315

Report No.(s): AD-A403322; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This proposal is designed to develop sequence specific DNA binding polyamides as an approach for specifically inhibiting Her2/neu expression, a gene that is over expressed in human breast cancers. The approach is to design polyamides that are optimized for targeting the binding of ESX a transcription factor which up regulates Her2/neu by binding to its consensus site within the Her2/neu promoter. Active agents are tested for their ability to inhibit Her2/neu expression in both cell free and cellular systems. A number of polyamides were identified as being effective inhibitors of ESX complex formation and their ability to block complexes was analyzed in detail. None of the agents were effective at preventing expression in cells. A series of fluorescently labeled polyamides representing structural diverse compounds were tested for their ability to localize in the nucleus of live cells. No agent was found to localize in the nucleus even at relatively high concentrations or for incubation times up to several days. Studies are underway to develop a new generation of polyamides that possess not only the ability to effectively target the Her2/neu promoter under cell free conditions but also to function effectively on nuclear DNA targets in intact cells.

DTIC

*Cancer; Mammary Glands; Deoxyribonucleic Acid*

**20020065258** Minnesota Univ., Minneapolis, MN USA

**Soy, Probiotics, and Breast Cancer Prevention** ***Annual Report, 15 Sep. 2000-14 Sep 2001***

Kurzer, Mindy S.; Oct. 2001; 6p; In English

Contract(s)/Grant(s): DAMD17-99-1-9297

Report No.(s): AD-A403323; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The purpose of this study is to investigate the effects of soy and probiotic consumption on estrogen and phytoestrogen metabolism. The methods include in vitro studies to determine the intestinal microflora responsible for phytoestrogen metabolism, and a human feeding study in which 20 postmenopausal breast cancer survivors and 20 controls consume four different dietary supplements for six weeks each. The supplements were: 1) soy powder; 2) soy powder + probiotic; 3) milk power; 4) milk powder plus probiotic. Urine was collected for three days before the study began and for three days at the end of each diet period, for evaluation of urinary estrogen and phytoestrogen metabolites. Food records were collected on the same days as the urines. Feces were collected before the study began and at the end of each diet period, for evaluation of intestinal microflora profiles. At this point, both in vitro and human studies have been completed. All subjects have completed the human feeding study, urines have been collected and processed and fecal samples have been analyzed. During the final year, the urine samples will be analyzed, data analyses will be performed, and manuscripts will be prepared for publication.

DTIC

*Cancer; Estrogens; Eating; Metabolism*

**20020065259** Meharry Medical Coll., Nashville, TN USA

**The Role of Galectin-3 in the Interactions Between Breast Carcinoma Cells and Elastin** ***Annual Report, 1 Sep. 2000-31 Aug. 2001***

Ochieng, Josiah; Sep. 2001; 15p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-99-1-9290

Report No.(s): AD-A403324; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Our overall objective is to delineate the role of galectin-3 in the interactions between breast carcinoma cells and elastin. Therefore the scope of this proposal is to prove to ourselves and convince the scientific community that expression of galectin-3 by breast cancer cells is not only important for growth, but also the interaction of these cells with elastin, an interaction which has significant consequences when one considers the propagation of metastatic cells in elastin rich tissues. We have at this point demonstrated by transfecting tumorigenic breast epithelial cells with antisense oligos to galectin-3 that indeed galectin-3 is critical for the interaction of these cells elastin. We have also demonstrated that fetuin, a serum glycoprotein is a necessary for these tumor cells to release galectin-3 which is then used to ligate the cells to elastin. We have also narrowed the motif in elastin which is involved to the VGVAPG chemotactic domain. As for the galectin-3 the interacting domain encompasses the carbohydrate

recognition domain. In the next year we hope to pinpoint the peptide domain(s) in galectin-3 which are responsible for galectin-3/elastin interaction.
DTIC
*Cells (Biology); Cancer; Interactions; Elastin*

**20020065260** Chicago Univ., Chicago, IL USA
**Molecular Markers in Hereditary Breast Cancer** ***Annual Report, 15 Sep. 2000-14 Sep 2001***
Olopade, Olufunmilayo I.; Oct. 2001; 6p; In English
Contract(s)/Grant(s): DAMD17-99-1-9123
Report No.(s): AD-A403325; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
The promise of research into breast cancer genetics is that it will provide us with new insights into the etiology of breast cancer that can be translated to strategies for early diagnosis and treatment for the larger population of women who develop breast cancer without having a genetic predisposition. An academic award represents an outstanding opportunity for me to critically appraise the emerging role of genetics in clinical breast cancer care and forge new avenues of research. Toward this goal, I plan to accomplish the following during the award period: 1) perform a thorough review of the cytogenetic and molecular genetics literature to identify potential chromosomal regions that may harbor genes whose abnormal function is critically involved in the development of breast cancer. 2) develop a robust panel of markers that can be used for clinical correlative studies of hereditary breast cancers. 3) develop a tissue repository composed of biological specimens from 500 patients with inherited breast cancer (e.g fresh frozen tumor specimens, or paraffin embedded tumor specimens and normal blood lymphocytes, DNA and sera whenever possible). These studies will lead to an improved understanding of the biology of breast cancer which will ultimately translate into more effective therapies.
DTIC
*Cancer; Genetics; Molecular Biology; Etiology*

**20020065261** University of Southern Illinois, Carbondale, IL USA
**American Ginseng in the Prevention and Treatment of Human Breast Cancer** ***Annual Report, 1 Aug. 2000-31 Jul. 2001***
Murphy, Laura L.; Aug. 2001; 14p; In English; Original contains color images
Contract(s)/Grant(s): DAMD17-99-1-9380
Report No.(s): AD-A403326; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The effects of ginseng on the prevention and treatment of breast cancer has not been studied. This research project was designed to examine the effects of American ginseng on breast cancer using well-established in vitro and in vivo experimental models. It is our hypothesis that ginseng, and its ginsenosides in particular, would inhibit the proliferation and growth of human breast cancer cells. Our results have shown that an extract of American ginseng inhibited MCF-7 and MDA-MB-231 cell proliferation in a dose-dependent manner. Furthermore, ginseng extract in the drinking water of female nude mice significantly decreased human breast cancer tumor growth. We have identified several different ginsenosides in ginseng extract and determined that only ginsenoside Rc potentially inhibited breast cancer cell proliferation in vitro. These findings are the first to suggest that ginsenoside Rc may be responsible for the anti-proliferating actions of ginseng extract on human breast cancer cell proliferation. We have also shown that ginsenoside Rh2, a component of Asian ginseng, significantly inhibited breast cancer cell proliferation. More recent data suggested that ginsenoside Rc may inhibit breast cancer cell cycle progression, whereas ginsenoside Rh2, especially at higher doses, is cytotoxic. Thus, different ginsenosides may have very different mechanisms of action.
DTIC
*Cancer; Cells (Biology); Plants (Botany)*

**20020065263** Washington Univ., Saint Louis, MO USA
**Definition of the T Cell-Mediated Immune Response to Mammaglobin, a Novel Breast Cancer-Associated Protein** ***Annual Report, 1 Aug. 2000-31 Jul. 2001***
Mohanakumar, Thalachallour; Aug. 2001; 35p; In English
Contract(s)/Grant(s): DAMD17-99-1-9434
Report No.(s): AD-A403328; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The elucidation of the immune response to cancer should be of great help in the development of new therapeutic strategies for the treatment of breast cancer. Based on recent advances in our basic understanding of antigen recognition by T lymphocytes, it has been possible to identify several human tumor-associated antigens (TAA) recognized by CTLs (cytotoxic T lymphocytes). However, the expression for these TAAs has been shown to be relatively low in BC (Breast Cancer) tumor cells. A new protein named mammaglobin has been demonstrated to be exclusively expressed in the mammary epithelium. In addition, 90% of primary

BC tumors have detectable levels of mammaglobin protein Given the exclusive mammaglobin expression in BC tumors, this novel protein may prove to be a TAA highly specific for BC that could be utilized in the near future for in vitro BC-specific activation of CTLs. The discovery of mammaglobin-derived antigenic peptides that are highly expressed in BC tumor tissue and are recognized by CTLs offer many exciting future therapeutic options for the treatment of BC.
DTIC
*Cancer; Cells (Biology); Epithelium; Lymphocytes*

**20020065264** Clemson Univ., SC USA
**Rational Design of Human Prolactin Receptor Antagonists for Breast Cancer Therapy** ***Annual Report, 15 Sep. 2000-14 Sep 2001***
Chen, Wen Y.; Oct. 2001; 48p; In English
Contract(s)/Grant(s): DAMD17-99-1-9129
Report No.(s): AD-A403330; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
There were three tasks proposed for the second year of this project. Majority of the tasks have been accomplished. We were able to produce and purify large amount of hPRl and hPRL-G129R using E. coli expression system. The purified proteins were used to carry out in vitro as well as in vivo characterization of the hPRL antagonist (four manuscripts and six abstracts were published) . We further confirmed that the antagonistic effects of hPRL-Gl29R in breast cancer cells are probably through the inhibition of STATs phosphorylation, caspase activation, or TGFs modulation. Based upon our initial studies, we have found that that proposed multi-cell receptor level comparison using conventional binding assay was not sensitive enough for differentiate the difference. We carried out real time RT-PCR studies to quantify the PRL-receptor level (manuscript published) . One negative result is also included in this report. We were unable to produce hPRL-BP in E.coli expression system. We are trying to use a new strain of E. coli from Novogen to overcome this problem in the coming year.
DTIC
*Cancer; Mammary Glands*

**20020065265** California Univ., Los Angeles, CA USA
**Latina Breast Cancer Patients and Their Informal Support System** ***Annual Report, 1 Sep. 2000-31 Aug. 2001***
Hayes-Bautista, David E.; Sep. 2001; 85p; In English
Contract(s)/Grant(s): DAMD17-99-1-9107
Report No.(s): AD-A403314; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
The purpose of this research project is to understand the influence of Latina culture in breast cancer treatment, by developing a conceptual model of the informal support system utilized by 60 triads consisting of Latina cancer patients, their spouses/significant others and family/friends. Participants are drawn from the Breast Cancer Treatment fund, which provides payment for services for uninsured women. Findings. The project has allowed a view into the role and function of the psycho-social support system. Not only does the support ”team” assist with the diagnosis, treatment and consequences of breast cancer, it also helps the patient ”connect the dots” of a disjointed system by negotiating, supplementing and extending services. Another key area of finding is that the supporting the spouse/partners has been neglected by the medical world. The loss of a breast does not seem to be as significant as the potential loss of a person key in creating a family. A better understanding of how the psychosocial team functions to assist the patient in ”connecting the dots” allows an understanding of where and how the services system does not reach into this population. Programs and policy at the individual and system level can emanate from the emerging conceptual model.
DTIC
*Cancer; Support Systems; Females*

**20020065267** Weizmann Inst. of Science, Rehovot Israel
**New Strategy for the Redirection of Cytolytic T Lymphocytes to Breast Tumors** ***Annual Report, 1 Sep. 2000-31 Aug. 2001***
Eshhar, Zelig; Sep. 2001; 36p; In English; Original contains color images
Contract(s)/Grant(s): DAMD17-99-1-9446
Report No.(s): AD-A403318; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The main objective of this research project has been to apply the T-body approach for the immunotherapy of breast cancer. to this end, we endowed human lymphocytes with anti-erbB2 specificity by transducing them with a tripartite chimeric receptor made of anti-erbB2 scFv-linked through the homeo-domain, trans membrane and endo-domain of cD28 to the cytoplasmic region of the FcR-gamma chain. In this report we describe an improved protocol for the preparation of a retrovector harboring the chimeric gene and efficient expression of this transgene in human T cells. The ability of the tripartite chimeric receptor to fully

activate primary T cells was demonstrated in vitro and in vivo using transgenic mice made with a model receptor. Transgenic mice that express erbB2-specific receptor have been generated and the ability of it's lymphocytes to reject erbB2 expressing tumors will be tested. to avoid tumor escape chimeric receptors of two scFv's from different antibodies were prepared. Using breast cancer xenografts we started to test the anti-tumor potency of erbB2-specific, genetically engineered human lymphocytes in SCID mice. In another pre clinical model, we have expressed the erbB2-specific tripartite chimeric receptor in murine stem cells and are studying their ability to mature into mature effector cells. Altogether, we expect from the model systems described above to establish the optimal conditions of using a T-bodies breast cancer therapy.
DTIC
*Lymphocytes; Tumors; Cytology; Genes*

**20020065269** Duke Univ., Medical Center, Durham, NC USA
**Functional Analysis of TGFRP, a Putative Angiogenic Factor, in Breast Carcinogenesis** ***Annual Report, 1 Jul. 2000-30 Jun. 2001***
Wang, Xiao-Fan; Jul. 2001; 11p; In English
Contract(s)/Grant(s): DAMD17-99-1-9178
Report No.(s): AD-A403320; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The primary goal of this project is to test the hypothesis that a newly identified protein, TGFRP, functions as an angiogenic factor to promote tumor progression and metastasis. As discussed in the research proposal, our preliminary results strongly support this postulation. With the generation of additional substantial experimental evidence from the proposed studies, we wish to firmly establish a role for TGFRP in the pathological process of breast carcinogenesis and lay the foundation for the development of novel therapeutics for the treatment of breast cancer.
DTIC
*Metastasis; Carcinogens; Cancer*

**20020065280** Brooke Army Medical Center, Fort Sam Houston, TX USA
**Wound Healing: The Effect of Supplemental Oxygen Therapy** ***Final Report, 01 Oct. 1996 - 30 Jun. 1998***
Mygrant, B. I.; Whitney, J. D.; Heiner, S. L.; Jul. 07, 1998; 28p; In English
Report No.(s): PB2002-107678; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy
The purpose of this pilot study was to clarify tissue and healing requirements with regard to the clinical use of oxygen (timing, dose, duration). Tissue oxygen and wound healing effects of short term, and postoperative oxygen therapy were tested. Twenty four subjects having fusion of the cervical spine and/or excision of a cervical intervertebral disc were enrolled in a randomized, experimental repeated measures design. The treatment group (n=13) received 28% oxygen for the first 36 postoperative hours. The control group (n=11) was maintained on room air. Subcutaneous tissue oxygen (PscO2) and temperature (TGsc) were measured pre-treatment and at postoperative hours 1-4, 18 and 36 using a tonometer/oxygen electrode system. Wound healing was evaluated by hydroxyproline content in a subcutaneous polytetrafluoroethylene (ePTFE) tube removed on the 7th postoperative day. Clinical wound complications were evaluated using the ASEPSIS Wound Scoring System and postoperative medical record view.
NTIS
*Wound Healing; Oxygen; Therapy; Injuries; Hyperbaric Chambers; Medical Services*

**20020065287** Illinois Univ., Broad of Trustees, Chicago, IL USA
**Role of Drug-Induced Fas Ligand Expression in Breast Tumor Progression** ***Annual Report, 1 Sep. 2000-31 Aug. 2001***
Beck, William T.; Oct. 2001; 14p; In English; Original contains color images
Contract(s)/Grant(s): DAMD17-99-1-9220
Report No.(s): AD-A403606; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Fas/FasL is a key regulator of apoptosis. In the past year, we have been trying to determine whether FasL is induced in vivo by anticancer agents. Although we did not detect any significant induction of FasL by VP-16 or doxorubicin, we found that Daxx, a Fas-associated protein, interacts with UBC9 that is implicated in regulating the subcellular localization of targeted proteins. Since only the cytosolic Daxx, not nuclear Daxx, is involved in enhancing Fas-mediated apoptosis, the regulation of the subcellular localization of Daxx is a key for its action. We found that while topoisomerase (topo) II inhibitors up-regulate Daxx, the same drugs reduce the binding ability of Daxx to UBC9, suggesting that the drugs may exert their impact on the subcellular localization of Daxx through UBC9. Furthermore, we showed that overexpression of a dominant negative UBC9 sensitizes cells to topo inhibitors, whereas resistance of tumor cells to cis-platin is associated with up-regulation of UBC9, suggesting a possible role of UBC9 in drug responsiveness. Consequently, further investigation on the interaction of Daxx and UBC9 in the context

of the subcellular localization of Daxx and drug responsiveness may provide insight into the molecular mechanism by which Daxx enhances Fas-mediated apoptosis.
DTIC
*Ligands; Drugs; Cells (Biology); Cancer*

**20020065299** Texas Univ., M. D. Anderson Cancer Center, Houston, TX USA
**Training Program in Breast Cancer Research at the University of Texas M.D. Anderson Cancer Center** ***Annual Report, 1 Sep. 2000-31 Aug. 2001***
Hung, Mien-Chie; Sep. 2001; 386p; In English; Original contains color images
Contract(s)/Grant(s): DAMD17-99-1-9264
Report No.(s): AD-A403550; No Copyright; Avail: CASI; A17, Hardcopy; A04, Microfiche

Under support from the US Army/DOD the training program in breast cancer research at University of Texas at M. D. Anderson Cancer Center has had a successful second year. The training program has supported four predoctoral and five postdoctoral fellows. As reported last year, the extra postdoctoral trainees are funded by Breast Cancer Research Program at UT-MDACC. Each trainee has made notable progress as evidenced by publications and presentations at national meetings. Some of trainees have completed his or her work before this progress report. Significant strides have been made within the scope of the original specific aims in the following research areas: I) Therapeutic approaches for breast cancer through regulation of oncogene and tumor suppressor gene expression, and control of signal transduction, apoptosis, and DNA repair; 2) Use of animals to understand the biology of breast cancer and to provide models for preclinical therapeutic and preventive studies; 3) Novel preventive strategies for breast cancer; 4) Population-based studies on breast cancer; 5) Molecular diagnostic/prognostic factors for breast cancer; and 6) The basis biology of breast cancer. In addition to laboratory pursuits each trainee has participated in departmental group meetings, journal clubs, and retreats. The goal of the training program is to further the successful training of fellows who will develop research programs of their own which continue to tackle problems of breast cancer.
DTIC
*Research Management; Gene Expression*

**20020065303** Alabama Univ., Dept. of Physics, Huntsville, AL USA
**EOX for Noninvasive Physiologic Monitoring** ***Final Report, 14 Dec. 1998-21 Dec 2001***
Hillman, Lloyd W.; Lompado, Art; Reardon, Patrick J.; Jun. 28, 2002; 4p; In English
Contract(s)/Grant(s): N00014-99-1-0226
Report No.(s): AD-A403422; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

An EOX is an instrument that scans low-powered lasers into a subject's eye and spectroscopically determines oxygen saturation of blood within the retinal veins and arteries. Pilot animal studies performed by our group with an EOX indicate that retinal venous oxygen saturation is a sensitive indicator of blood loss. We have developed a 2-D scanning EOX which is readily reconfigured to operate at various wavelengths, and to use confocal techniques and polarization to constrain the potential sources of collected light. Thus, the instrument is being used to fully explore the physics of retinal oximetry, with the goal of a calibrated instrument. The parallel development of a model eye allows for rapid verification of EOX modifications on a test object with far fewer unknowns. Data collection across varying oxygen saturation, hemoglobin concentration, vessel diameter, fund us reflectivity, and filtering configurations permits analysis of the contributions of each of these components to the actual complex measurement. This data has been critical to improving our understanding of the algorithms necessary for calibrating the EOX. Finally, a human pilot study performed on subjects in a Lower Body Negative Pressure experiment was also accomplished, successfully acquiring data on 15/15 subjects.
DTIC
*Eye (Anatomy); Physiology; Algorithms; Oximetry*

**20020065305** Johns Hopkins Univ., School of Medicine, Baltimore, MD USA
**Strategic Manipulation of Tumor Antigens to Enhance Immunogenicity** ***Annual Report, 1 Sep. 2000-31 Aug. 2001***
Hess, Allan D.; Sep. 2001; 26p; In English
Contract(s)/Grant(s): DAMD17-99-1-9238
Report No.(s): AD-A403419; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Systemic chemotherapy including high dose chemotherapy with stem cell rescue frequently induces responses in women with metastatic breast cancer Unfortunately, disease often recurs due to the persistence of chemotherapy resistant tumor cells. The immune system can effectively target and kill chemotherapy resistant tumor cells. Tumor associated antigens particularly antigens derived from the Her-2/neu oncogene can be recognized in breast cancer. Strategies to enhance immune recognition of these

antigens may provide a therapeutic benefit. Recent studies indicate that the N-terminal flanking region of the invariant chain peptide termed CLIP has superagonisitc properties. The central hypothesis of this research project is that the N-terminal flanking region of CLIP can augment the immunogenicity of cryptic 'self' peptide epitopes from Her-2/neu. Ongoing studies indicate that immunization with chimeric constructs of an MHC class II binding peptide antigen from Her-2/neu presented on tumor cells or on dendritic cells in concert with an MHC class I binding peptide from Her-2/neu induces a potent cytolytic T cell response and protective antitumor immunity. Further analysis of the cell-mediated immune mechanisms reveals that immunization with the chimeric Her-2/neu construct triggers a type 1 cytokine (IL-2, IFN(sub gamma) T helper cell response. The type 1 cytokine response may underlie the induction of protective antitumor immunity allowing for the clonal amplification of effector T cells and inducing upregulation of target antigens on the tumor cell. Importantly, immunization with the chimeric construct appears to enhance antitumor immunity even in the presence of growing tumors. Augmenting the immune response to tumor associated antigens will enhance therapeutic strategies for the treatment of breast cancer.
DTIC
*Antigens; Chemotherapy; Immunology; Physiological Responses; Tumors*

**20020065307** California Univ., San Diego, La Jolla, CA USA
**Regulation of the Activity and Stability of the Tumor Suppressor p53 In Vivo** ***Annual Report, 1 Oct. 2000-30 Sep. 2001***
Xo, Yang; Oct. 2001; 20p; In English
Contract(s)/Grant(s): DAMD17-99-1-9105
Report No.(s): AD-A403430; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Following DNA damage, p53 protein level is increased and its activity induced, leading to cell-cycle G1 arrest or apoptosis depending on cell type. Our research is focused on two aspects of p53 biology: (1) Elucidation of signaling pathways activating p53 following DNA damage; and (2) Understanding the importance of p53 transcriptional activity in the p53-dependent apoptosis and tumor suppression. During the past year, we have completed the analysis of p53 responses to DNA damage in p53Ser18Ala mutant ES cells, indicating that phosphorylation of mouse p53 at Ser 18 by is required for a full p53 responses to DNA damage. In addition, we have introduced this mutation into mouse germline for further in vivo analysis. We have also introduced Ser/Thr to Ala mutations at the JNK/MAP kinase phosphorylation sites and preliminary analysis of the mutant indicates that these phosphorylation events are not required for p53 responses to DNA damage but might be involved in cellular proliferation. We have also demonstrated that p53 transcriptional activity is required for p53-dependent apoptosis in both ES cells and thymocytes following DNA damage. We have introduced the p53G1n25Ser26 mutation into mouse germline to test the importance of p53 transcriptional activity in p53-dependent tumor suppression.
DTIC
*Stability; Tumors; Neoplasms; In Vivo Methods and Tests; Activity (Biology)*

**20020065313** Harbor-UCLA Medical Center, Research and Education Inst., Torrance, CA USA
**Brain Function, Structure, and Neurochemistry After Tamoxifen/Chemotherapy Assessed by Neuropsychologic Testing and 1H Magnetic Resonance Spectroscopy** ***Annual Report, 1 Sep. 2000-31 Aug. 2001***
Ernst, Thomas; Sep. 2001; 28p; In English
Contract(s)/Grant(s): DAMD17-99-1-9210
Report No.(s): AD-A403373; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Loss of mental abilities represents a recognized threat to the quality of life of postmenopausal women with advancing age. Most recently, several reports have used a sensitive method (neuropsychological testing) to evaluate younger women with breast cancer after chemotherapy and hormonal modifying therapy (with tamoxifen), and found that a substantial percentage of these women had reduced mental abilities compared to women who were not treated with chemotherapy and hormonal modifying therapy. It also appears that these mental deficits are overlooked by the screening tests currently used in many large-scale breast cancer treatment and prevention studies, most likely because these simple screening tests become abnormal only when the brain is damaged to a moderate or severe degree. In the previous studies, most of the women with mental deficits obtained both chemotherapy and hormonal modifying therapy, so that it is unclear which of the two therapies caused the mental deficits. Furthermore, tens of millions of healthy women without breast cancer may soon obtain hormonal modifying therapy (with tamoxifen and possibly other drugs) to prevent future breast cancer; therefore, it is extremely important to know whether these drugs may cause injury to the brain and long-lasting problems with mental abilities. This study is designed to address these questions.
DTIC
*Chemotherapy; Cancer; Drugs; Mental Performance*

**20020065315** Virginia Univ., Charlottesville, VA USA

**The Integrin-Regulated Kinase PYK-2: A Therapeutic Target for Prostate Cancer** ***Annual Report, 1 Sep. 2000-31 Aug. 2001***

Edlund, Magnus; Chung, Leland W.; Sep. 2001; 75p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-99-1-9528

Report No.(s): AD-A403406; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A prostate cancer cell's growth, differentiation and survival are guided by its interactions with the surrounding extracellular matrix (ECM) . A number of promising therapeutic targets for androgen-independent and metastatic prostate cancers are contained within the signaling cascades downstream of the ECM-binding Integrin molecules. My research focuses on one component of these cascades, the phospho-tyrosine kinase PYK-2, whose expression levels and activity I aim to manipulate in cell culture and within tumors in mice. This past year, after redirecting my research approach somewhat because of technical difficulties, I can now report that I have: 1) characterized PYK-2 expression in prostate tissues and cell lines; 2) linked Green Fluorescent Protein (GFP) to both PYK- 2 and dominant-negative PYK-2 (PRNK), transiently transfected cells with these constructs, and studied protein localization and construct effects on cell growth, apoptosis and migratory behaviors; 3) quantified integrin subunit expression levels in cell lines of different metastatic potential and assayed the tyrosine phosphorylation states of endogenous PYK-2, following cell adhesion to different ECM substrata; 4) generated a virus expression vector with a tissue-specific promotor that will be used for in vivo animal experiments; and finally 5) begun microarray analysis of gene expression changes accompanying shifts in the levels of PYK-2 and PRNK. The work is ongoing and will continue in my new position at Emory University.

DTIC

*Cancer; Culture Techniques; Gene Expression; Phosphorylation; Prostate Gland; Tyrosine*

**20020065319** California Univ., Berkeley, CA USA

**Roles of BRCA2 Gene in Homologous Recombination and Genomic Stability** ***Annual Report, 1 Sep. 2000-31 Aug. 2001***

Chen, David J.; Sep. 2001; 11p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-99-1-9170

Report No.(s): AD-A403331; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Brca2 tumor suppressor gene is important for maintaining genomic integrity because, at least in part, of a role in homologous recombinational repair. Brca2 is presumed to function in homologous recombination through its interactions with Rad51. Both exon 11 and 27 of Brca2 code for domains that interact with Rad51; exon 11 codes for eight BRC motifs, while exon 27 codes for a single, distinct interaction domain. Deletion of all the Rad5 i-interacting domains causes early embryonic lethality in mice. A less severe phenotype is seen in mice with deletions that preserve some, but not all, of the BRC motifs. These mice can survive past weaning, but are runted, infertile, and die very young from cancer. Cells derived from such mice are hypersensitive to some genotoxic agents and exhibit chromosomal instability. Here we present analysis of mice and cells with a deletion of the single Rad51-interacting region encoded by exon 27 (all the BRC motifs are preserved). This mutation is called brca2lex1. Mice homozygous for brca2lex1 exhibit a shorter life span compared to control littermates, possibly due to an early onset of cancer and sepsis. No other phenotype was observed in these animals; therefore, the brca2lex1 mutation is less severe than those with larger COOH-terminal truncations that delete some of the BRC motifs. However, at the cellular level, the brca2lex1 mutation causes reduced viability, extreme sensitivity to the DNA interstrand cross-linking agent mitomycin C, and gross chromosomal instability, much like the more severe truncations..

DTIC

*Mutations; Genes*

**20020065320** Colorado Univ., Health Sciences Center, Denver, CO USA

**The Role of Molybdenum Hydroxylase Generated Free Radicals in Alcohol Induced Breast Cancer** ***Annual Report, 1 Sep. 2000-31 Aug. 2001***

Wright, Richard M.; Sep. 2001; 13p; In English

Contract(s)/Grant(s): DAMD17-99-1-9149

Report No.(s): AD-A403348; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The breakdown of alcohol may contribute to the risk for breast cancer (BC) through the generation of toxic by-products of oxygen, (reactive oxygen species,(ROS)) that can produce the DNA mutations and chromosome damage found in BC. ROS can be evolved stochiometrically from cytochrome P450-E11 (CYP-E11) in the first step of alcohol degradation and subsequently by the action of xanthine oxidoreductase (NOR) and aldehyde oxidase (AOX) that consume acetaldehyde and NADH. We have proposed that these enzymes in the breast are responsible for the formation of ROS following alcohol consumption, and we suggest

that ROS derived from alcohol will produce the DNA mutations and chromosome damage that lead to breast cancer. Our studies have shown that breast tissue expresses substantial levels of CYP-E11, NOR, and AOX. Furthermore, our recent studies have demonstrated that the genes encoding XOR and AOX are activated by cytokines and growth factors known to have significant affects on the mammary gland. Cytokine stimulated cultured epithelial cells produced ROS that could be blocked by inhibitors of NOR, hence activation of these enzymes generates intracellular ROS. We suggest that activation of ROS generating genes in the breast may contribute to alcohol mediated ROS toxicity leading to BC.
DTIC
*Cancer; Drinking*

**20020065321** Johns Hopkins Univ., School of Medicine, Baltimore, MD USA
**Prevention of Breast Cancer by Targeted Disruption of Breast Epithelial Cells** ***Annual Report, 1 Sep. 2000-31 Aug. 2001***
Sukumar, Saraswati; Sep. 2001; 7p; In English
Contract(s)/Grant(s): DAMD17-99-1-9242
Report No.(s): AD-A403346; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We proposed to test the validity of the hypothesis that introduction of recombinant toxins into the confines of the mammary ductal tree through the teat will kill breast epithelial cells. to this end, we designed a new toxin to target epithelial cells. We have completed the construction of a chimeric toxin consisting of the protein transduction domain of the HIV TAT gene to target and enter the cells, and the VPR gene of HIV to cause apoptosis. Expression of this protein in bacteria, and its purification is in progress. In animal experiments, we also demonstrated the concept that both chemopreventive and chemotherapeutic drugs could be clinically effective when delivered by the intraductal route. This allows us to ask if, by this route of administration, systemic toxicity could be avoided. In the third year of this grant we will test the efficacy of this toxin in cultured human and rat breast cells. If effective, we will test the toxin in the rat model system.
DTIC
*Cancer; Mammary Glands; Toxins and Antitoxins; Epithelium*

**20020065322** Illinois Univ. at Urbana-Champaign, Urbana, IL USA
**An Estrogen Receptor-Selective Coactivator: A Potential Regulator of Tamoxifen Effectiveness in Breast Cancer Treatment and Prevention** ***Annual Report, 1 Sep. 2000-31 Aug. 2001***
Rajendran, Ramji R.; Sep. 2001; 15p; In English
Contract(s)/Grant(s): DAMD17-99-1-9219
Report No.(s): AD-A403344; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Much evidence demonstrates that the estrogen receptor (ER) is involved in breast cancer development and progression. We have isolated a novel 97 kDa DEAD box RNA helicase protein (p97), from breast cancer cells, which interacts with the estrogen receptor E and F domains in the presence of either estradiol or trans-hydroxytamoxifen. We have further confirmed the interaction of p97 with ER using both GST-pulldown analysis and a mammalian two-hybrid assay. We have localized a C-terminal (662-864) portion of p97 that specifically interacts with the EF region of the estrogen receptor. In reporter gene assays of transiently transfected cells, p97 decreases the transcriptional activity of agonist-occupied estrogen receptor, progesterone receptor, glucocorticoid receptor, and retinoic acid receptor. However, p97 has no effect on the transcriptional activity of p53 or VP1 6. p97 has intrinsic repression activity on a constitutively active promoter when recruited to it with a Gal4 DNA binding domain. We have identified a small region of p97 that retains this intrinsic repression activity. Trichostatin A, a selective histone deacetylase inhibitor, is able to reverse the repressive activity of p97 on ER, suggesting an involvement of the histone deacetylase complex with p97. Further analysis of this coregulator will allow insight into nuclear receptor function and its role in breast cancer.
DTIC
*Cancer; Estrogens; Proteins*

**20020065323** Washington Univ., Grant and Contract Services, Seattle, WA USA
**Molecular Quantitation of Breast Cancer Cells in the Peripheral Blood: Correlation With Clinical Stage at Presentation and Disease Course** ***Annual Report, 1 Sep. 2000-31 Aug. 2001***
Sabath, Daniel E.; Sep. 2001; 6p; In English
Contract(s)/Grant(s): DAMD17-99-1-9439
Report No.(s): AD-A403343; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The overall objective of this project is to develop an assay to detect small numbers of breast cancer cells in a patient's peripheral blood. This assay would be used to test the hypothesis that the presence of circulating breast cancer cells would be predictive of stage at presentation or relapse. The first stage of this project has been to optimize a quantitative reverse

transcriptase-polymerase chain reaction (qRT-PCR) to quantify breast cancer-specific RNA molecules in the peripheral blood. The result of this initial work was to select keratin 19 (K19) RNA as the best target for detecting small numbers of breast cancer cells. We have also selected an internal reference RNA (beta2-microglobulin), and we have optimized our protocol for extracting RNA from patient blood samples. The second phase of this project has been to develop methods to enrich blood samples for tumor cells, thereby increasing the sensitivity of the assay. Having optimized these parameters, we plan to use the qRT-PCR assay for K19 RNA to study patients with breast cancer, both at the time of presentation and after treatment.
DTIC
*Cancer; Mammary Glands; Cells (Biology); Bioassay*

**20020065324** Maryland Univ., Baltimore, MD USA
**A Controlled Study Using Acupuncture as an Adjuvant to Treat Chemotherapy-Induced Nausea and Vomiting** ***Annual Report, 1 Sep. 2000-31 Aug. 2001***
Lao, Lixing; Sep. 2001; 5p; In English
Contract(s)/Grant(s): DAMD17-99-1-9274
Report No.(s): AD-A403341; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This is a randomized, double blind controlled study designed to assess the effects of electroacupuncture (EA) on nausea and vomiting (N/V) induced by chemotherapy in cancer patients. The primary aim of this study is to evaluate the usefulness of EA as an adjuvant on N/V in chemotherapy patients who do not respond to conventional antiemetics. Seventy-five outpatients will be recruited from the University of Maryland Baltimore (UMB) Cancer Center who have shown refractory to 5-HT3 antiemetic and randomized into three treatment groups (n=25 per group): (1) EA: 10 hz, 10 min, (2) EA: 100 Hz, 10 min, and (3) a sham acupuncture control group. Research team personnel are in place and recruitment began in January 2000. As of August 31, 2001, 101 patients had been screened, 18 judged as eligible, and 10 have consented to go on the protocol and have now completed the study. The study has experienced difficulty with obtaining sufficient numbers of patients due to the low prevalence of nausea and vomiting among the chemotherapy patients at the UMB Cancer Center. For this reason an amendment is being submitted to the IBB (and permission will be requested from the DOD) to extend the study into the Cancer Center's Bone Transplant Unit, which (pending approval) will begin in November, 2001.
DTIC
*Chemotherapy; Cancer; Nausea*

**20020065326** Beth Israel Medical Center, NY USA
**Levels of Distress in Women With a Family History of Ovarian Cancer** ***Annual Report, 1 Sep. 2000-31 Aug. 2001***
Kash, Kathryn M.; Sep. 2001; 29p; In English
Contract(s)/Grant(s): DAMD17-00-1-0571
Report No.(s): AD-A403356; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The overall goal of this study is to determine the levels of distress in women with a family history of ovarian cancer and to identify the mediating factors between risk of developing ovarian cancer and distress. The proposed study will use 180 first-degree relatives (FDR) of women diagnosed with ovarian cancer in a cross-sectional design. Information the ovarian cancer index case provides will be used to identify maternal relatives (mothers, sisters, or daughters). Women will be queried about their objective and subjective risk status, their knowledge of ovarian cancer and risk factors, their uncertainty about ovarian cancer, levels of anxiety and depression, their personality traits of mastery, tolerance for ambiguity, and optimism, and their interest in genetic testing. With the results generated by this study, specific interventions can be designed and tested to improve adjustment of women at high risk for ovarian cancer. This study has not begun but is anticipating a start date of April 05, 2002, once the IRB gives its approval. We are proposing a stepped-up recruitment, which includes contacting not only index cases who come to the clinic but the cancer registry and cancer support programs lists. Our goal is to recruit 180 first-degree relatives of women with ovarian cancer by October 2003.
DTIC
*Cancer; Genetics; Females*

**20020065327** Scripps Research Inst., La Jolla, CA USA
**Adhesive Mechanisms in Breast Cancer Metastasis** ***Annual Report, 1 Oct. 2000-30 Sep. 2001***
Felding-Habermann, Brunhilde; Oct. 2001; 44p; In English; Original contains color images
Contract(s)/Grant(s): DAMD17-99-1-9968
Report No.(s): AD-A403354; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Complications from metastatic disease are the primary cause of death in breast cancer. We found that human breast cancer cells can express the adhesion receptor integrin alpha v beta 3 in an activated or a non-activated functional form. Expression of the activated, but not the non-activated receptor supports metastatic dissemination. Mechanisms through which activated integrin alpha v beta 3 promotes metastasis include: binding of soluble ligand, support of tumor cell arrest during blood flow through tumor cell interaction with platelets, and promotion of breast cancer cell migration. Activated integrin alpha v beta 3 promotes breast cancer migration by cooperating with metalloproteinase MMP-9. A model mechanism for this cooperation is proposed. Our new findings support the originally proposed concept, that activation of breast cancer cell integrin alpha v beta 3 supports the metastatic phenotype in the tumor cells. Thus, these studies identify activated alpha v beta 3 as a new functional marker of metastatic breast cancer cells and indicate that activated alpha v beta 3 should be considered as a novel target for the inhibition of breast cancer metastasis.
DTIC
*Metastasis; Cells (Biology); Adhesion; Cancer*

**20020065328** National Academy of Sciences - National Research Council, Insti. of Medicine, Washington, DC USA
**The Anthrax Vaccine. Is It Safe? Does It Work?**
Joellenbeck, Lois M.; Zwanziger, Lee L.; Durch, Jane S.; Strom, Brian L.; Jan. 2002; 282p; In English
Contract(s)/Grant(s): DASW01-00-6-3045
Report No.(s): AD-A403352; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche
Anthrax Vaccine Adsorbed (AVA) was licensed in 1970 to provide protection against infection with Bacillus anthracis. AVA was initially administered on a limited basis, primarily to protect veterinarians and workers processing animal products such as hair or hides that could be contaminated with anthrax spores. In the 1990s, with growing concerns about the possible use of anthrax as a biological weapon, use of the vaccine was substantially expanded. The Department of Defense (DoD) vaccinated some of the military personnel deployed for the Gulf War in 1991 and in 1998 initiated the Anthrax Vaccine Immunization Program, calling for mandatory vaccination of all U.S. service members. by late 2001, roughly 2.1 million doses of AVA had been administered. Production of AVA was suspended in 1998 when the facility manufacturing the vaccine was closed for renovations, which were undertaken to meet regulatory requirements of the Food and Drug Administration (FDA). Concerns about the efficacy and safety of AVA, and about vaccine production, led Congress to direct the DoD to support an independent examination of AVA by the Institute of Medicine. In October 2000, the Institute of Medicine convened the Committee to Assess the Safety and Efficacy of the Anthrax Vaccine. The committee reviewed all available data, both published and unpublished, and heard from representatives of DoD, FDA, and other federal agencies; from the vaccine manufacturer BioPort; from researchers studying the efficacy and safety of the vaccine; and from service members and others with concerns about the safety or efficacy of the vaccine. After the bioterrorism of fall 2001, the committee accelerated its original timetable for its review. As indicated by evidence from studies in both humans and animals, the committee concluded that AVA, as licensed, is an effective vaccine to protect humans against anthrax, including inhalational anthrax.
DTIC
*Vaccines; Biological Weapons; Infectious Diseases; Immunology*

**20020065329** Northeastern Univ., Boston, MA USA
**A Structure Based, Solid Phase Synthesis Approach to the Development of Novel Selective Estrogen Receptor Modulatory Steroids** ***Annual Report, 1 Jun. 2000-31 May 2001***
Hanson, Robert N.; Jul. 2001; 68p; In English
Contract(s)/Grant(s): DAMD17-99-1-9333
Report No.(s): AD-A403350; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
The objective of this project is the development of new chemotherapeutic agents for the treatment of hormone-responsive breast cancer using a structure-based solid phase synthesis approach. During the past year we have utilized our functionalized resin to prepare a second series of carboxamido-phenylvinyl estradiols. The compounds were characterized by NMR and analyzed by computational methods. The new agents were evaluated for estrogen receptor binding affinity and in vivo efficacy. The results suggest that incorporation of functional groups at the specific sites proposed reduces both affinity and efficacy, however, positional isomers and configurational isomers had better activity. These observations have been incorporated into the design of the second generation steroids that will be prepared and evaluated in the third year of the project.
DTIC
*Cancer; Mammary Glands; Estrogens; Steroids*

**20020065335** Texas Univ. Health Science Center, San Antonio, TX USA

**Training Program in the Molecular Basis of Breast Cancer Research** ***Annual Report, 1 Aug. 2000-31 Jul. 2001***

Lee, Wen-Hwa; Aug. 2001; 247p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-99-1-9402

Report No.(s): AD-A403408; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

The objective of the program is to train highly qualified doctoral students in the genetic, cellular, and molecular basis of Breast Cancer. The training program, conducted within the Molecular Medicine Ph.D. Program, was administered by a select group of faculty whose research projects were intimately involved in breast cancer. An additional goal of the program was to promote synergistic interactions between the various laboratories engaged in breast cancer research. Breast cancer meetings, Molecular Medicine Distinguished Seminar Series were integral parts of the training program for students supported by the Breast Cancer Training Program. The major strengths of the program were the high quality of the Program faculty, and the interactive nature of the Breast Cancer research community in San Antonio. The program faculty, organized into three subprograms, encompassed scientists and physicians studying different aspects of breast cancer and cancer therapy, as well as fundamental mechanisms of DNA repair, cell growth and cell differentiation. Key research accomplishments during the 1999-2000 reporting period were: (1) publication of 30 peer-reviewed articles by students in the program; (2) two DoD BCRP pre-doctoral grants awarded to students in the program; (3) the addition of five new highly qualified faculty; and (4) four faculty awarded DoD BCRP Idea grants; and (5) five Ph.D. students supported by the program graduated.

DTIC

*Cancer; Education; Mammary Glands; Molecular Biology; Genetics*

**20020065336** Baltimore Univ., MD USA

**Retroviral Transfer of Human Mutated Thymidylate Synthase Gene into Hematopoietic Stem Cells for Protection from High-Dose Fluoropyrimidine Toxicity** ***Annual Report***

Takebe, Naoko; Gallo, Robert; Oct. 2001; 17p; In English

Contract(s)/Grant(s): DAMD17-99-1-9372

Report No.(s): AD-A403426; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In the field of breast cancer, the significant cytoreduction followed by consolidation chemotherapy has been accepted to reduce disease relapse in breast cancer. However, myelosuppression still impose restrictions on the optimization of this treatment modality. Insertion of drug resistance genes into hematopoietic progenitor cells offers an additional approach to allow further dose intensification and treatment post transplant. We have generated and characterized human thymidylate synthase (TS) mutants, one of which resulted in a 15 fold increase Ki for 5-fluoro2-deoxyuridylate (FdUMP) compared to the wild type TS. This mutant TSG52S transfectant confers a 97 fold resistance to fluorodeoxyuridine (FdUrd) in TS negative mouse cell lines. 5-fluorouracil (5-FU), is a commonly used drug in breast cancer treatment with significant myelosuppressive effects. We hypothesize that after administration of high dose chemotherapy, transplanted progenitor cells transduced with the fluoropyrimidine drug resistance gene, TSG52S, will allow for higher doses of 5-FU to be given during maintenance therapy without significant myelosuppression possibly leading to improved cure rates Therefore, the overall objective is to develop retroviral vectors and efficient viral transduction methods for introducing TSGE2S into mouse and human hematopoietic progenitor cells and then to evaluate the level of resistance to myelosuippression from 5-FU this method produces.

DTIC

*Chemotherapy; Genetics; Hematopoietic System; Mutations; Cells (Biology); Mammary Glands*

**20020065339** Albert Einstein Coll. of Medicine, Bronx, NY USA

**Analysis of Metastasis in Transgenic Mice** ***Annual Report, 1 Jun. 2000-31 May 2001***

Segall, Jeffrey E.; Jun. 2001; 11p; In English; Original contains color images

Report No.(s): AD-A403427; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The goal of this project is to analyze the metastasis of mammary tumors in transgenic mice. This will make use of fluorescently labeled tumor cells to allow in vivo visualization of the tumor cells in the primary tumor as well as in target organs. For the first year of this project we have generated 3 transgenic lines carrying the MMTV-GFP expression construct. We have evaluated GFP fluorescence in one of these lines (founder 25) and are in the process of testing two others. Heterozygotes derived from founder 25 show GFP fluorescence in mammary ducts and are now being crossed with transgenic mice carrying the HER2/neu or polyoma middle T transgene.

DTIC

*Metastasis; Mice; Mammary Glands; Gene Expression*

**20020065340** Georgetown Univ., Medical Center, Washington, DC USA

**Ribozyme Targeting of Steroid Receptor Co-Activators: A Therapeutic Approach to Breast Cancer** ***Annual Report, 15 Sep. 2000-14 Sep 2001***

Riegel, Anna T.; Oct. 2001; 14p; In English

Contract(s)/Grant(s): DAMD17-99-1-9203

Report No.(s): AD-A403442; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The gene of the nuclear receptor coactivator AIB1 is amplified in breast cancer cell lines as well as in breast tumor tissue. AIB1 mRNA is often highly expressed in primary breast tumors and is has been shown that AIB1 enhances estrogen and progesterone dependent transcription in vitro. Therefore it has been postulated that AIB1 contributes to the development of breast cancer. However, it is currently not known what the precise role of AIB1 is in the development of breast cancer. to address this question we established MCF-7 breast cancer cell lines in which we can regulate AIBL levels with ribozymes in order to determine the impact of reduced AIB1 gene expression on the phenotype and angiogenic or invasive properties of breast cancer cells. Here we report that depleflon of endogenous AIB1 levels reduced steroid hormone signaling via the estrogen receptor-alpha or progesterone receptor-beta as well as estrogen-mediated inhibition of apoptosis and cell growth. Furthermore, we demonstrate that upon reduction of endogenous AlBL expression, estrogen-dependent colony formation in soft agar and tumor growth of MCF-7 cells in nude mice was decreased. We conclude that AIB1 exerts a rate-limiting role for hormone dependent human breast tumor growth.

DTIC

*Cancer; Gene Expression; Mammary Glands; Steroids*

**20020065343** Colorado Univ., Health Sciences Center, Denver, CO USA

**Role of Nuclear Receptor Coregulators in Hormone Resistant Breast Cancer** ***Annual Report, 1 Sep. 2000-31 Aug. 2001***

Graham, Justine D.; Sep. 2001; 20p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-99-1-9145

Report No.(s): AD-A403446; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

To determine whether the agonist activities of tamoxifen are exaggerated in hormone-resistant breast cancers. Scope. We proposed that coregulatory proteins influence the direction of transcription by antagonist-occupied steroid receptors. We screened for such proteins, and identified three novel cDNA fragments encoding peptides that interact with antagonist-bound PRs. The aims were to clone the complete cDNAs and define their structure (Aim 1); define the role of the unknown proteins on receptor activity (Aim 2); and, if appropriate, determine the role of these proteins in hormone dependency of breast cancers (Aim 3). Major Findings - Results. We have focused on one novel cDNA fragment, designated ORF#g3. We cloned the full-length cDNA; assembled its genomic structure; localized the gene to chromosome I 5q23. I; expressed the full-length protein; defined its tissue distribution; determined its subcellular localization to be cytoplasmic; and generated a polyclonal antibody that probes a 103 kDa protein. Functional studies have been completed. The protein is not a ligand-specific transcriptional regulator, but does affect overall transcription. Antisense studies show ORF#93 also blocks corepressor action on ER. The protein does not affect PR nuclear translocation, but interacts also with hsp9O; Significance. We now believe that ORF#93 has a cytoplasmic ”scaffolding” function, and allows receptors to interact with other proteins in multiprotein complexes, perhaps in association with hsp9O. If so, ORF#93 may be important for cross-talk between growth factor and nuclear receptor signaling pathways.

DTIC

*Cancer; Hormones; Mammary Glands; Receptors (Physiology); Genome*

**20020065347** Texas Univ., M. D. Anderson Cancer Center, Houston, TX USA

**Immune Suppression Following Acute Exposure to Volatile Organic Chemicals** ***Final Report, 1 Oct. 1997-30 Dec. 2001***

Ullrich, Stephen E.; Dec. 2001; 3p; In English

Contract(s)/Grant(s): F46920-98-1-0008; AF Proj. 2312

Report No.(s): AD-A403547; AFRL-SR-AR-TR-02-0214; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The focus of these experiments was to test the hypothesis that dermal application of military jet fuel (JP-8) is immune suppressive. Three specific aims were designed to test this hypothesis: (1) Does dermal exposure to JP-8 induce immune suppression? (2) What are the mechanisms involved? (3) Can you reverse the immune suppressive effects of JP-8? Applying JP-8 to the skins of mice does suppress the immune response. The mechanisms underlying immune suppression appear to involve the production of immune regulatory cytokines and biological response modifiers by JP-8-treated keratinocytes. In particular we found that the immune suppression induced by JP-8 was mediated by Prostaglandin E2 and interleukin-10. Understanding the mechanism(s) involved provided a method to reverse immune suppression. Neutralizing the activity of Prostaglandin E2 and interleukin-10 in vivo blocked JP-8-induced immune suppression. Prostaglandin E2 production in vivo was blocked with a

selective cyclooxygenase-2 inhibitor. Because this class of drugs is now available for use in humans(i.e., Celebrex), the data generated here suggest that using selective cyclooxygenase-2 inhibitors to block prostaglandin-2 production ill Vivo may present the best way to prevent JP-8-induced immune suppression in USAF personnel.
DTIC
*Organic Compounds; Biological Effects; Immune Systems*

**20020065362** Civil Aerospace Medical Inst., Oklahoma City, OK USA
**Laboratory Comparison of Clockwise and Counter-Clockwise Rapidly Rotating Shift Schedules, Part 1, Sleep** ***Final Report***
Cruz, C.; Detwiler, C.; Nesthus, T.; Boquet, A.; May 2002; 26p; In English
Report No.(s): PB2002-107798; DOT/FAA/AM-02/8; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Many air traffic control specialists work relatively unique counter-clockwise, rapidly rotating shift schedules. Researchers recommend, however, that if rotating schedules are to be used, they should rotate in a clockwise, rather than a counterclockwise direction. Unfortunately, few studies have examined clockwise and counter-clockwise, rapidly rotating shifts. This study was designed to partially remedy this lack by examining the effects of both types of schedules on sleep duration, timing, and quality. Participants (n=28) worked a week of day shifts (0800-1600), followed by two weeks of either a Clockwise (n=14) or Counter-Clockwise (n=14) shiftwork schedule, including early morning (0600-1400), afternoon (1400-2200), and midnight shifts (2200-0600). Participants recorded sleep data in daily logbooks and wore wrist activity sensors to provide an objective source of sleep/wake data.
NTIS
*Air Traffic Controllers (Personnel); Schedules; Air Traffic Control*

**20020065414** Mount Sinai School of Medicine, New York, NY USA
**A Randomized Prospective Trial Comparing Paravertebral Block and General Anesthesia for Operative Treatment of Breast Cancer** ***Annual Report, 1 Feb. 2000-1 Sep. 2001***
Weltz, Christina R.; Greengrass, Roy; Klein, Stephen; Oct. 2001; 153p; In English
Contract(s)/Grant(s): DAMD17-98-1-8128
Report No.(s): AD-A403664; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche
The goals of the study are to evaluate the role of paravertebral blocks regional anesthesia in patients undergoing operative treatment of breast cancer. Experience to date has shown that this anesthetic modality is safe and effective, and associated with excellent postoperative pain control and minimization of nausea and vomiting associated with general anesthesia. Using a prospective randomized trial carried out at two institutions, we propose to measure quality of life variables including pain, postoperative nausea and vomiting, mood, and functional status in patients undergoing breast surgery with the traditional techniques of general anesthesia versus the region technique of paravertebral block. The preliminary phase of this trial, which establishes the safety and efficacy of performing the block technique, is complete. We are currently in the study portion of the trial and have consented and randomized a total of 9 patients at one institution thus far. Outcomes and study instruments are detailed in the report. Our collaborating institution, the Mayo Clinic Jacksonville, is awaiting final institutional approval in order to begin recruiting patients.
DTIC
*Vertebrates; Pain; Anesthesia*

**20020065415** Johns Hopkins Univ., School of Medicine, Baltimore, MD USA
**Fatty Acid Synthesis and Prostate Cancer: Hormonal Regulation and Anti-Metabolite Targeting of an Acquired Function in Neoplasia** ***Annual Report, 1 Oct. 2000-30 Sep. 2001***
Pizer, Ellen S.; Oct. 2001; 14p; In English
Contract(s)/Grant(s): DAMD17-99-1-9580
Report No.(s): AD-A403665; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The overall goal of this project is to determine the regulatory mechanisms that activate fatty acid (FA) synthetic metabolism during malignant progression of prostate cancer, and to evaluate FA synthesis as a therapeutic target. The biosynthetic enzyme, fatty acid synthase (FAS), is expressed at elevated levels in PCa cells, and is a marker of tumors with activated FA synthesis. While FAS expression is androgen responsive, it persists or is reactivated in tumors after androgen ablation, and is high in 83% of lethal tumors examined at autopsy. Experimental model systems of PCa (in vitro and in vivo) show similar patterns of FAS activation, with increased FAS during progression to androgen independence. Tumor cell changes in fatty acid metabolism are insensitive to nutritional regulation, and tumor cells produce predominantly membrane lipids. Our recent experiments have led to the

observation that growth factor signals mediated by activated kinases in PCa cells and transformation models activate the fatty acid synthesis pathway, resulting in the tumor phenotype of activated FA metabolism that is insensitive to nutritional regulation. Small molecules that inhibit FAS are cytotoxic to tumors, and the mechanism of tumor cell killing is under investigation.
DTIC
*Hormones; Fatty Acids; Prostate Gland*

**20020065416** Johns Hopkins Univ., Baltimore, MD USA
**Automatic Exposure Control Device for Digital Mammography** ***Annual Report, 1 Aug. 2000-31 Jul. 2001***
Fajardo, Laurie L.; Aug. 2001; 32p; In English; Original contains color images
Contract(s)/Grant(s): DAMD17-99-1-9429
Report No.(s): AD-A403655; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The broad, long-term objective of this IDEA proposal is to achieve optimized image quality for DM within acceptable limits of radiation exposure by developing innovative approaches for controlling DM exposures. These approaches entail using the digital detector and an artificial neural network to control mammographic exposures. This project's specific aims are: (1) to use short, low dose pre-exposures of the breast to create "intelligent" regions of interest that determine the exposure parameters for the fully exposed image; and (2) to use an artificial neural network to select exposure parameters (mAs, kVp, and beam filtration) based on "intelligent decisions" that optimize signal-to-noise (SNR) as a function of mean glandular dose.
DTIC
*Automatic Control; Exposure; Cancer; Radiation Dosage; Control Equipment*

**20020065417** California Univ., Berkeley, CA USA
**Expression Profiling of Tyrosine Kinase Genes** ***Annual Report, 1 Aug. 2000-31 Jul. 2001***
Weier, Heinz-Ulrich; Aug. 2001; 46p; In English; Original contains color images
Contract(s)/Grant(s): DAMD17-99-1-9250
Report No.(s): AD-A403657; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Aberrant expression of receptor or cytosolic tyrosine kinase genes and, in particular, their hyper-expression are common phenomena in breast cancer, which are believed to alter cell growth and response to external signals such as growth factors, hormones etc. Knowledge about the relative levels of expression of many tyrosine kinase genes, all at the same time, might contribute significantly to a better understanding of the processes of tumor development and progression. We are developing a rapid assay that will use innovative cDNA micro-arrays carrying small amounts of individual tyrosine kinase gene-specific targets to simultaneously determine the expression levels of up to 100 tyrosine kinase genes using a small number of cells. Three years of research and development will lead to discovery of a set of gene-specific markers associated with breast cancer progression and a simple device capable of performing inexpensive expression profiling of these markers. The research and development efforts in the first year of this 3-year project focused on the design and testing of robotic instruments to prepare DNA micro-arrays and the preparation of prototype arrays carrying sets of more than 50 gene-specific tyrosine kinase fragments. The second year effort (i.e., the reporting period 1 Aug 2000-31 Jul 2001) was directed towards the optimization of cDNA preparation, labeling, hybridization and detection protocols as well as the molecular cloning and sequencing of breast cancer-specific tyrosine kinase gene transcripts.
DTIC
*Genes; Tyrosine; Cancer; Cell Division; Cloning (Biology)*

**20020065418** Minnesota Univ., Minneapolis, MN USA
**A Novel Approach to Increase Breast Cancer Cell Chemosensitivity: Disuption of the Anti-Apoptotic Function of Translation Factor eIF4E** ***Annual Report, 1 Oct. 2000-30 Sep. 2001***
Polunovsky, Vitaly A.; Oct. 2001; 13p; In English
Contract(s)/Grant(s): DAMD17-99-1-9298
Report No.(s): AD-A403660; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
In this report we present data in support of Aim 2 of our project. Utilizing human breast carcinoma cell lines as an in vitro model for naturally occurring malignancy, we demonstrated that enforced overexpression of translation factor eIF4E in human mammary epithelial cells (HMECs) confers to them a transformed phenotype and protects against apoptotic death. In accord with this, suppression of eIF4E-driven translation by ectopic expression translational repressor 4E-BP1 stimulated apoptosis and abrogated chemoresistance breast carcinoma cells in a manner dependent on the phosphorylation status of ectopic 4E-BP1. Our data show that targeted disruption of cap-dependent translational machinery selectively sensitizes breast carcinoma cells to the subset anti-cancer drugs that includes camptothecin and doxorubicin. These drugs are considered as promising candidates for

collaboration with anti-eIF4E pre-treatments in suppression of breast tumor growth. Based on these data, we plan to employ novel pharmacological approaches including disruption of eIF4E-to-cap association by phosphoramidated analogues of the 5' methylguanosine cap of mRNA.
DTIC
*Mammary Glands; Cancer; Apoptosis; Pharmacology*

**20020065419** Colorado State Univ., Fort Collins, CO USA
**Role of Melatonin in the Prevention of Breast Cancer in Patients with Cystic Breast Disease** ***Annual Report, 1 Sep. 2000-31 Aug. 2001***
Wells, Robert; Sep. 2001; 116p; In English
Contract(s)/Grant(s): DAMD17-99-1-9143
Report No.(s): AD-A403645; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
Melatonin and breast cyst fluids (BCFs) both exert antiproliferative effects on breast cancer cells that may be mediated by growth factors. The primary objectives of this study are to establish a clinical BCF sample bank among patients with gross cystic breast disease to study of the relationship between this disease, melatonin and related growth agents in BCF, and breast cancer risk. BCF samples from participating patients will be used to elucidate the contribution of melatonin and related growth agents (EGF, TGF-beta, DHEA-S) to the oncostatic effects of BCFs on MCF-7 human breast cancer cells. Our progress to date includes the establishment of a BCF sample bank and continued patient enrollment in year 2. Assay procedures were established for each biochemical analyte specified in the statement of work and BCF samples were analyzed for: melatonin, sodium, potassium, TGF-beta 1, TGF-beta 2, EGF, and DHEA-S. Preliminary time course, dose-response, and repeatability experiments were initiated using BCF to treat MCF-7 cells. A protocol was established for exposing MCF-7 cells with BCF and treatments were performed using samples from recruited patients. In summary, cell culture experiments using BCF samples and corresponding biochemical composition assays continued in year 2 and will progress into year 3.
DTIC
*Cysts; Cancer; Hormones; Culture Techniques*

**20020065421** North Carolina Univ., Chapel Hill, NC USA
**Novel Oncogenes in Breast Cancer Development** ***Annual Report, 1 Jul. 2000-30 Jun. 2001***
Fiordalisi, James J.; Der, Channing; Jul. 2001; 9p; In English
Contract(s)/Grant(s): DAMD17-99-1-9331
Report No.(s): AD-A403648; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
The complex nature of the genetic events that trigger the development of breast cancer remain to be identified. Our laboratory has developed and refined a retrovirus-based gene transfer assay to identify activated oncogenes in breast cancer. Progress during the past year has involved: (1) development of better functional screens for activated oncogenes; (2) evaluation of protocols to improve the rescue of cDNAs from the transformed cell populations; and (3) preliminary analyses of isolated transforming genes. We have generated several retrovirus-based cDNA expression libraries that represent genes expressed in noninvasive (T4TD) or invasive (MDA-MB4682, BT549 and Hs578T) human breast cancer cell lines. The T47D library has been introduced into Rat-1 rodent fibroblasts and RIE-1 rat intestinal epithelial cells and transforming activity was then assayed for. Whereas empty retrovirus vector-infected cells did not show any transforming activity, cultures infected with breast tumor cDNAs showed the appearance of over 100 colonies of transformed cells. Two isolates from our analyses encode proteins with known growth-promoting functions: the Raf-1 serine/threonine kinase and the fibroblast growth factor receptor 2. A third, syntaxin 6, a protein involved in intracellular vesicular transport has not been linked previously to oncogenesis.
DTIC
*Genes; Genetics; Cancer; Oncogenes*

**20020065424** Hawaii Univ., Office of Research Services, Honolulu, HI USA
**Identification of Junctionally-Transmitted Growth Inhibitors** ***Annual Report, 15 Jul. 2000-14 Jul 2001***
Bertram, John S.; Aug. 2001; 11p; In English
Contract(s)/Grant(s): DAMD17-98-1-8196
Report No.(s): AD-A403636; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
We have proposed the identification of junctionally transmitted growth control signals which we hypothesize to be responsible for the growth inhibition of tumor cells when in junctional communication with normal cells. We have genetically engineered human breast cancer cells to express connexin 43 under the control of a tetracycline-inducible promoter. When induced these cells regain junctional competence and their neoplastic potential is reduced in two important respects: one, when in

communication with growth inhibited normal cells their proliferation is reduced; two, when these cells are cultured in suspension in soft agar, their colony formation is strongly reduced. Thus connexin 43 is acting as a tumor suppressor gene in these breast cancer cells. Increased junctional communication could thus lead to reduced progression of this disease. We have encountered significant problems in the molecular analysis of cells cultured in both situations. In co-culture, it is proving difficult to analyze one cell type without contamination by the second; in anchorage independent growth conditions, it is proving difficult to obtain sufficient cells for analysis without contamination with agarose. Both problems are being actively addressed.
DTIC
*Neoplasms; Genes; Cells (Biology); Contamination; Cancer*

**20020065426** Baylor Coll. of Medicine, Houston, TX USA
**Functional Significance of Mutant p53 in Breast Cancer** ***Annual Report, 1 Jul. 2000-30 Jun. 2001***
O'Lear, Renee; Jul. 2001; 10p; In English
Contract(s)/Grant(s): DAMD17-99-1-9074
Report No.(s): AD-A403639; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Approximately 50% of human cancers have accumulated missense mutations in the gatekeeping tumor suppressor protein p53, usually resulting in genomic instability and a very poor prognosis. The wild-type p53 protein is required for assessing DNA damage in cells and making the decision to either induce cell cycle arrest to facilitate DNA repair, or to induce a suicide response in those cells with irreparable damage. In human tumors, many hot-spot mutations are found within the DNA-binding domain of p53, rendering it incapable of sequence-specific transactivation of target genes such as p21, bax, and mdm2. Some of these mutants, in addition to having dominant-negative functions, also gain novel functions by interacting with proteins differently from the wild-type p53 protein. One such gain-of-function p53 mutant possesses an Arg to His substitution at codon 175 (172 in mice) and has been shown to be involved in the dysregulation of centrosome duplication leading to abnormal mitoses and subsequent aneuploidy. Because centrosome abnormalities and aneuploidy are often seen in high-grade breast tumors, unraveling the mechanism behind the involvement of p53172 B-H in centrosome dysregulation will help us to understand the progression of mammary carcinogenesis. In order to identify potential indirect target genes regulated by this mutant, we employed a suppressive subtractive hybridization technique to generate a cDNA library specific to p53 null mammary epithelial cells (MECs) expressing the 172 B-H mutant. cDNA made from p53 null mammary epithelial cells transiently transfected with wild-type p53 was subtracted from cDNA made from mutant p53 transfected cells. The subtraction procedure generated a pool of cDNAs differentially expressed in the presence of the mutant protein; many interesting genes were revealed to be candidates for regulation by mutant p53.
DTIC
*Proteins; Mutations; Genes*

**20020065427** Boston Univ., Medical Center, Boston, MA USA
**Communication, Cultural Models of Breast Cancer Beliefs and Screening Mammography: An Assessment of Attitudes Among Haitian Immigrant Women in Eastern MA** ***Annual Report, 1 Jul. 2000-30 Jun. 2001***
David, Michele M.; Jul. 2001; 129p; In English
Contract(s)/Grant(s): DAMD17-99-1-9082
Report No.(s): AD-A403640; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Many Haitian adhere to a traditional system of attitudes and beliefs about health and illness, which may result in delays in presentation for breast cancer and other serious illnesses, but are readily forthcoming about this adherence. Many Haitian immigrant women are not aware of the purpose of screening mammography, and present late for evaluation of breast lumps and abnormal findings at mammography. Reliable knowledge of factors associated with cultural beliefs about breast cancer will allow accurate, culturally tailored interventions to be developed and implemented, and may reduce morbidity and mortality resulting from late presentation in Haitian women with breast cancer. This is an in-person, randomized, cross-sectional survey of 250 women, 40 years of age and older, who reside in or near Haitian neighborhoods in Boston, Cambridge, Somerville, and Brockton, all cities known to have neighborhoods with high concentrations of Haitian families. Through this innovative study, we will provide credible evidence about cultural factors that may contribute to delays in cancer screening and/or impede cancer evaluation and treatment. Our findings will allow accurate, effective cultural interventions to be designed, based on data collected from the target population.
DTIC
*Cancer; Mammary Glands; Females; Health*

**20020065456** Dana Farber Cancer Inst., Boston, MA USA

**Avoiding Late Cardiac Effects of Radiation Treatment of Breast Cancer by Simple Respiratory Maneuvers** ***Annual Report, 1 Oct. 2000-30 Sep. 2001***

Lu, Hsiao-Ming; Oct. 2001; 15p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-99-1-9084

Report No.(s): AD-A403641; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The second year, also the final year, of this contract is for completing the software development of the patient position control system and then performing phantom testing and patient testing at both CT-simulator where the patient's treatment is planned and at the treatment unit where the treatment is delivered. The software development has achieved all the goals: an efficient marker recognition algorithm has been developed and the user interface for the position control module has been enhanced by providing real-time plot of marker positions and by implementing automated point capture procedures. Moreover, a database and the associated browser have been created to handle the patient data in a network environment to make data available both at the simulator and at the treatment unit. Phantom test of the overall accuracy of the system has been conducted at CT-simulator with satisfactory results. Significant efforts have also been made to experiment in making smaller hollow hemispherical markers that can be more accurately placed on patient's skin surface and yet do not interfering with the radiation treatment. The planned tests using both phantom and real radiation patients were not conducted due to the unexpected delay in installing the system in the treatment room. For this reason, a no-cost extension was filed and approved.

DTIC

*Respiratory System; Heart; Radiation Effects*

**20020065462** Georgetown Univ., Washington, DC USA

**Dietary Prevention of Breast Cancer** ***Annual Report, 15 Aug. 2000-14 Aug 2001***

Hilakivi-Clarke, Leena A.; Sep. 2001; 126p; In English

Contract(s)/Grant(s): DAMD17-99-1-9196

Report No.(s): AD-A403634; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The goal of this Academic Award is to appraise critically the state of dietary prevention of breast cancer and to forge new avenues of investigation in the field of nutrition. This goal consists of two specific aims: (1) to determine the importance of timing of specific dietary exposures on breast cancer risk; and (2) to develop a novel nutrition and cancer program to the Pi's institution. Following achievements have been made towards the aims: (1) the Pi's laboratory is currently focusing on investigating the impact of an exposure, either during in utero period through a pregnant dam, during prepubertal period or during pregnancy, to different types of dietary fats, phytoestrogens and alcohol on breast cancer risk. Since the beginning of the second year of the award period in 7/1/00, these studies have generated 6 published, 2 in press, and 2 submitted papers, and 4 manuscripts in preparation. The studies show That ill utero exposure to n-6 or n-3 polyunsaturated fatty acids (PUFAs), genistein or soy may have opposite effects on mammary tumorigenesis than prepubertal exposures. Human studies have also been completed or in progress to determine whether the findings obtained in animal models are relevant to breast cancer prevention in women. (2) A new course (PI is The course director) entitled "Life style and cancer prevention" was taught for a first time as part of the Tumor Biology graduate program at Georgetown University. In addition, The PI has obtained a planning grant from NCI to develop a program consisting of several RO1 type awards to study The interactions among nutrition, genes and cancer.

DTIC

*Nutrition; Fatty Acids; Estrogens; Cancer; Diets*

**20020065509** Wayne State Univ., Detroit, MI USA

**Modulation of Growth and Differentiation in Breast Cancer by Soy Isoflavones** ***Annual Report, 1 Oct. 2000-1 Oct 2001***

Kucuk, Omer; Nov. 2001; 6p; In English

Contract(s)/Grant(s): DAMD17-98-1-8353

Report No.(s): AD-A403703; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Our studies investigate the in vivo effects of soy isoflavones on human breast tissues obtained from lumpectomy/mastectomy specimens. We investigate the effect of increased tissue concentration of isoflavones for a period of three weeks on breast cancer proliferation, differentiation and cell cycle regulatory proteins. Patients with ductal carcinoma in situ (DCIS) or invasive breast cancer are randomly assigned to take 100 mg soy isoflavone (Novasoy-Trademark, Archer Daniels Midland Company, Decatur, Illinois) or placebo daily for three weeks prior to surgery. Plasma isoflavone levels are measured at baseline and after three weeks in both groups. Tissue specimens by immunohistochemistry and Western blot. These studies will enable us to determine if a short duration or exposure to increased tissue levels of isoflavones will modulate biomarkers of cell differentiation (Cx43), adhesion (E-cadherin), proliferation (MIB-1), and cell growth and apoptosis (bcl-2. bax, p53, p21, Rb, EGF-R, cyclin D1, CDK5, CDK6)

in benign, pre-malignant and malignant areas of breast epithelial tissues. Biomarker studies on the patients randomized on this study will be completed in early 2003. We have conducted a pilot study in six women, who took soy isoflavones 50 mg (Novasoy-Trademark) daily for three weeks. DNA was isolated from the nuclei of peripheral blood lymphocytes and analyzed for levels of 5-hydroxy-methyl-2'-deoxyuridine (5-OHmdU) by gas chromatography-mass spectrometry. The mean level of 5-OHmdU was decreased by 35% (relative to baseline) after 1 week and by about 50% after 2 weeks and 3 weeks of supplementation. Mean plasma levels of 8-isoprostane also decreased after supplementation.
DTIC
*Cancer; Mammary Glands*

**20020065510** Colorado Univ., Health Sciences Center, Denver, CO USA
**Tamoxifen Resistant Breast Cancers: Inappropriate Transcriptional Coregulators** ***Annual Report, 16 Aug. 2000-15 Aug 2001***
Horwitz, Kathryn B.; Sep. 2001; 17p; In English; Original contains color images
Contract(s)/Grant(s): DAMD17-99-1-9146
Report No.(s): AD-A403705; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The antiestrogen, tamoxifen, is currently the most effective hormonal agent for the treatment of breast cancer. The presence of nuclear estrogen (ER) and progesterone (PR) receptors in tumors is a strong prognostic marker for tamoxifen responsiveness. However, most tumors that initially regress, eventually become tamoxifen "resistant" and resume growing. Resistant tumors usually retain their ER. Tamoxifen is a mixed agonist/antagonist, a property that it shares with the antiprogestin RU486. Under certain conditions, mixed antagonists can impart strong, agonist-like, transcriptional activity. We postulated that in tamoxifen-resistant breast cancers, tamoxifen acquires strong agonist-like properties which override its antagonist effects. As a result, tamoxifen acts like an estrogen and enhances tumor growth. Our hypothesis as to the mechanism of hormone resistance involves the inappropriate recruitment of coregulatory proteins to the transcriptional machinery that switches the affect of antagonist hormones on their respective receptors. to define the molecular events that cause such a switch we used an antagonist-driven yeast two-hybrid screening strategy and isolated three antagonist-specific, receptor-interacting peptides. Our long-term goal is to understand how tamoxifen resistance develops, with a view to either preventing or reversing it.
DTIC
*Cancer; Estrogens; Hormones*

**20020065517** Loyola Univ. Chicago, Maywood, IL USA
**Psycho-Endocrine-Immune Profile: Implications for Quality of Life in Breast Cancer Patients** ***Annual Report, 1 Nov. 2000-31 Oct. 2001***
Janusek, Linda J.; Nov. 2001; 113p; In English
Contract(s)/Grant(s): DAMD17-98-1-8120
Report No.(s): AD-A403697; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
Biopsy of the breast for cancer diagnosis is an emotional experience, characterized by anxiety and fear. This experience may impair immune responses. This study evaluated a woman's immunological and psychological response pre and post breast biopsy. Perceived stress, anxiety, and mood disturbance were heightened pre-biopsy. Post-biopsy; perceived stress, anxiety, and mood disturbance decreased but did not return to levels reported by non-biopsied control women. Natural killer (NK) cell activity was significantly depressed pre and post biopsy, when compared to non-biopsied, control women. Post biopsy, NK cell activity was less than that exhibited pre biopsy. No changes in number of NK cells were observed at either pre or post biopsy time points. Production of INF-gamma was significantly reduced pre and post biopsy and production of IL-4, IL-6, and IL-10 were significantly increased by the experience of breast biopsy. The reduction in NK cell activity after breast biopsy was more marked in women with malignant breast biopsy findings. The results also suggest that women who report the highest levels of stress or mood disturbance have the most marked changes in immune function. Thus, impending breast biopsy is marked by increased perceived stress, anxiety, and mood disturbance, which is relieved post-biopsy, but does not return to levels reported by non-biopsied women. In conclusion, stress-induced alterations in immunity are not transient but persist beyond the acute experience of the biopsy. This may be of particular relevance to women diagnosed with malignancy since they will be facing additional stressors related to cancer treatment and adaptation to illness.
DTIC
*Emotions; Cancer*

**20020065519** Missouri Univ., Columbia, MO USA

**Viral Vectors Selective for Metastatic Breast Cancer Tumor Cells** ***Annual Report, 1 Oct. 2000-1 Oct 2001***

Folk, William; Nov. 2001; 9p; In English

Contract(s)/Grant(s): DAMD17-98-1-8321

Report No.(s): AD-A403699; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We are developing gene therapy vectors derived from purified polyomavirus capsid proteins. We hope to achieve selective targeting of the vectors by expressing on their surface, sequences that bind receptors present on the surface of cancer cells. We have modified the polyomavirus VP1 capsid protein to contain sequences derived from urokinase plasminogen activator (uPA) responsible for binding to the urokinase plasminogen activator receptor (uPAr) and with sequences capable of binding to the ErbB2 receptor. These modified VP1 proteins have been expressed in insect cells. Methods for their purification have been developed, and their capacity to assemble into virion-like particles (VLPs) assessed by electron microscopy and by sedimentation analyses. We have demonstrated self-assembly of vP1 proteins containing both uPA and ErbB2 ligands into VLPs, which should enhance the specificity of binding to cells expressing both receptors. We have determined that the modified vP1 loses its capacity to bind to sialic acid, a major component of the normal binding of polyomavirus to cells, and we are presently attempting to determine the specificity of the homotypic and heterotypic VLP for cancer cells.

DTIC

*Genes; Cancer*

**20020065521** Vanderbilt Univ., Medical Center, Nashville, TN USA

**The Role of Mitotic Events in Taxol Mediated apoptosis in Breast Cancer Cells** ***Annual Report, 1 Dec. 2000-30 Nov. 2001***

Pietenpol, Jennifer A.; Dec. 2001; 71p; In English

Contract(s)/Grant(s): DAMD17-99-1-9422

Report No.(s): AD-A403689; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

For a drug that is used so widely in breast cancer therapy, little is known about the mechanism of Taxol action. Although Taxol's binding to tubulin is well characterized and the ability of the drug to induce a mitotic arrest is recognized, the biochemical mechanisms by which these events lead to breast cancer cell cytotoxicity are not known. The objective of this research is to test the hypothesis that prolonged activation of CDC2 and subsequent phosphorylation of Bcl2 are required for Taxol-mediated apoptosis in breast cancer cells. The ultimate goal of the research is to identify a signaling cascade(s) that is important for the cytotoxic effects of Taxol. Progress to date includes: (1) development of cell model systems to analyze the role of Bcl2 phosphorylation in susceptibility to Taxol-mediated apoptosis; (2) determining that Bcl2 overexpression provides a selective advantage for cell survival and growth in anchorage-independent settings in vitro and in vivo; and (3) preliminary confirmation that Taxol-induced modulation of mitotic events that is observed in cell culture models is operational in vivo. It is critical to understand how Taxol works at the molecular level in order to pursue rational design of new drugs for the treatment of breast cancer.

DTIC

*Cancer; Cells (Biology); Drugs; Apoptosis; Mitosis*

**20020065522** Georgetown Univ., Medical Center, Washington, DC USA

**Strategies of Discovering Small Molecular Drugs Targeting Growth Factor Heregulin** ***Annual Report, 1 Sep. 1999-31 Aug. 2001***

Yang, Dajun; Sep. 2001; 19p; In English

Contract(s)/Grant(s): DAMD17-99-1-9208

Report No.(s): AD-A403690; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Heregulin (HRG) constitutes the HRG subfamily of EGF-related peptides that were isolated from breast cancer cell line MDA-MB-231, and ras-transformed Rat-1 fibroblasts. HRG can stimulate proliferation and may function as an autocrine growth factor in transformed mammary epithelial cells. Stable expression of HRG via transfection leads tumor formation in nude mice and might perform a role in progression to estrogen-independent tumor growth. Furthermore, HRG induces in vivo lobuloalveolar development of mammary gland, and in MMTV-HRG transgenic mice, HRG induces mammary adenocarcinoma, and hyperplasia. Clinically, elevated expression of HRG play a role in breast cancer growth and progression and is associated with less favorable disease outcome. We have used a structure-based strategy towards the discovery of small molecules as potential HRG antagonists. Small, non-peptidal molecules which mimics the 3D structure of HRG binding domain could specifically block ligand receptor-binding. Lead compound SMA1 demonstrated activity as specific antagonists of HRG in receptor binding competition, HRG-induced phosphorylation assays and HRG-dependent cell proliferation assays. Inhibition of HRG- induced phosphorylation or cell growth can be reversed by addition of extra amount of HRG, suggesting the compound SMA1 may

function as HRG antagonist. The discovery of compounds represents an important step in the development of the small molecule, HRG antagonists as potential clinical candidates in the prevention and treatment of breast cancer.
DTIC
*Carcinogens; Drugs; Growth*

**20020065527** Chicago Univ., Chicago, IL USA
**Improved MR Images of Breast Lesions with Fast Spectroscopic Imaging** ***Annual Report, 15 Sep. 2000-14 Sep 2001***
Karczmar, Gregory S.; Oct. 2001; 9p; In English
Contract(s)/Grant(s): DAMD17-99-1-9121
Report No.(s): AD-A403614; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Work during the first year of funding resulted in development of a high resolution echo planar imaging sequence for our whole-body GE SIGNA scanners. This sequence was tested in phantoms and volunteers. During the second year of funding, we increased the number of normal volunteers scanned (n=15) and scanned women with biopsy-confirmed breast cancer (n=7) and women with suspicious lesions on mammography (n=5). We developed and implemented improved methods of data analysis and performed quantitative comparisons of high spectral and spatial resolution (HiSS) images with conventional images. These comparisons demonstrate that under our experimental conditions HiSS provides improved fat-suppression, improved contrast, texture, edge delineation, and increased sensitivity to contrast media, relative to conventional MRT. These results are described papers in press in Radiology and Academic Radiology as well as another manuscript in progress. At the same time, we have continued to develop software for our GE scanners and now have a version of high resolution EPSI that runs on our recently upgraded SIGNA scanners. This version of the pulse sequence is incorporated into the standard clinical breast imaging protocol this will allow us to increase the number of patients who are scanned after informed consent is obtained.
DTIC
*Clinical Medicine; Cancer; Spectroscopy*

**20020065528** Case Western Reserve Univ., Cleveland, OH USA
**TIG3 - A Novel Inhibitor of Breast Cancer Cell Proliferation** ***Annual Report, 1 Sep. 2000-31 Aug. 2001***
Eckert, Richard L.; Sep. 2001; 9p; In English; Original contains color images
Contract(s)/Grant(s): DAMD17-99-1-9115
Report No.(s): AD-A403611; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The mechanism of inhibition of cancer cell proliferation by vitamin A is poorly understood because many of the targets that mediate the retinoid-dependent growth suppression are not known. We have recently identified a novel retinoid-responsive gene target, TIG3, that we believe may be a key player in mediating the retinoid-dependent suppression of tumor cell proliferation. Understanding the mechanism of TIG3 action may provide insights that lead to innovative new anti-breast cancer therapies. Exploiting this potential requires that we understand how TIG3 inhibits cell proliferation - the major goal of this proposal. Specific Aim I Subcellular location plays a major role in determining function, and knowing location provides clues about function. Therefore, our first goal is to localize TIG3 in breast cancer cells. Specific Aim 2 Most proteins contain distinct functional domains, some responsible for localization and others for function. We hypothesize that TIG3 is divided into distinct functional domains that are important for growth suppression. We are testing this hypothesis. Specific Aim 3 The TIG3 amino acid sequence/structure reveals no obvious catalytic functional domains, suggesting that TIG3 acts by modulating the function of other proteins. A major goal of the study is to identify these targets. During the first year we have 1) constructed a plasmid-based TIG3 expression systems and used it to express TIG3 in cells; 2) identified a perinuclear localization of TIG3 in cells; 3) demonstrated that the TIG3 carboxy-terminal hydrophobic domain guides appropriate subcellular localization; 4) shown that the TIG3 carboxy-terminal tail is required for optimal cell killing, and 5) constructed an adenovirus expression system that permits efficient TIG3 expression for biochemical studies.
DTIC
*Cancer; Retinene*

**20020065529** British Columbia Univ., Vancouver, British Columbia Canada
**Analysis of Phenotypic Variability in Neurofibromatosis Type I (NF1)** ***Final Report, 30 Sep. 1997-29 Sep 2001***
Friedman, Jan M.; Oct. 2001; 257p; In English
Contract(s)/Grant(s): DAMD17-97-1-7347
Report No.(s): AD-A403609; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

This project was designed to characterize the sources of phenotypic variability in neurofibromatosis 1 (NF1) by a combination of clinical, statistical, epidemiological, and molecular genetic methods. We have analysed associations found in clinical and

genetic data from the NNFF International Database and two other databases with logistic regression and generalized estimating equations. We then extended these methods to use multivariate probit models on familial data. These are novel statistical techniques that have not been used in this way before and yielded interesting results about the sources of phenotypic variability. We were able to determine that the presence of some features of NF1 are more influenced by variability in the NF1 allele, others by the normal NF1 allele and still others by unlinked modifying genes. We have set up, and tested the screening protocol to identify the constitutional mutations of NF1 and have obtained a number of blood samples. We have results for one of our phenotypic subgroups and are completing the analysis at the present time.
DTIC
*Nervous System; Genetics; Multivariate Statistical Analysis*

**20020065530** Dana Farber Cancer Inst., Boston, MA USA
**Inhibition of Estrogen Receptor Action by the Orphan Receptors, SHP and DAX-1** ***Annual Report, 1 Sep. 2000-21 Aug. 2001***
DiRenzo, James; Sep. 2001; 13p; In English
Contract(s)/Grant(s): DAMD17-99-1-9163
Report No.(s): AD-A403608; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The estrogen receptor (ER) is a critical diagnostic marker and therapeutic target for a large number of breast cancers. The elucidation of the mechanisms by which ER controls the growth of certain breast cancers may provide new targets of intervention that would disrupt estrogen signaling in hormone-dependent breast cancers. SHP and Dax-1 are members of the nuclear receptor superfamily of ligand activated transcription factors that have been shown to interact with other nuclear receptors in a hormone dependent manner. In support of grant number DAMD17-99-1-9163 the findings presented here describe interactions between ER and DAX-1 and also ER and SHP. These interactions have been determined to be both direct and hormone-dependent. Functional studies of this interaction indicate that both DAX-1 and SHP act as negative regulators of ER signaling. Mutational analysis has identified regions in the amino-terminus of SHP and DAX-1 that are required for the interaction with ER. These analyses have demonstrated that subtle variations of a leucine-rich motif LXXLL, found within SHP and DAX-1 mediate the interaction. These studies suggest that SHP and DAX may act as negative regulators of ER signaling that may compete with the p160 coactivators and help to recruit co-repressors.
DTIC
*Cancer; Estrogens; Receptors (Physiology)*

**20020065531** Texas Univ., M. D. Anderson Cancer Center, Houston, TX USA
**Differential Processing of Cyclin E Variants in Normal vs Tumor Cells and Their Role in Breast Cancer Oncogenesis** ***Annual Report, 1 Sep. 2000-31 Aug. 2001***
McGahren, Mollianne J.; Keyomarsi, Khandan; Sep. 2001; 7p; In English
Contract(s)/Grant(s): DAMD17-99-1-9214
Report No.(s): AD-A403607; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
The major goal of this fellowship is to examine the difference in expression of lower molecular weight isoforms of cyclin E between normal and tumor cells. to this end we had proposed to determine the differences in processing of the full length cyclin E into its LMW forms between normal and tumor cells. As a first step toward fulfillment of this aim we had proposed to repeat transfection of FLAG-tagged cyclin E between normal and tumor cells using a GFP reporter gene transfection. We also had proposed to repeat the transfection in two other normal and cell lines. We had further proposed to perform immunoprecipitation study of the truncated FLAG cyclin E on transfected cells and lastly to further clone more truncated cyclin E forms within the proposed region for processing.
DTIC
*Cancer; Proteins; Genes*

**20020065538** NASA Ames Research Center, Moffett Field, CA USA
**Exercise Thermoregulation in Men after One and 24-hours of 6 Degree Head-Down Tilt**
Ertl, A. C., NASA Ames Research Center, USA; Dearborn, A. S., NASA Ames Research Center, USA; Weldhofer, A. R., NASA Ames Research Center, USA; Bernauer, E. M., NASA Ames Research Center, USA; Greenleaf, J. E., NASA Ames Research Center, USA; Sep. 04, 1998; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only
Exercise thermoregulation exercise is dependent on heat loss by increased skin blood flow (convective and conductive heat loss) and through enhanced sweating (evaporative heat loss). Reduction of plasma volume (PV), increased plasma osmolality,

physical deconditioning, and duration of exposure to simulated and actual microgravity reduces the ability to thermoregulate during exercise.
Author
*Physical Exercise; Thermoregulation; Blood Flow; Convective Heat Transfer*

**20020065545** NASA Ames Research Center, Moffett Field, CA USA
**Effects of Single-Task Interference on Dual-Task Interference**
Johnson, James C., NASA Ames Research Center, USA; Ruthruff, Eric, NASA Ames Research Center, USA; VanSelst, Mark, NASA Ames Research Center, USA; Remington, Roger W., NASA Ames Research Center, USA; [1998]; 1p; In English; Psychonomics Society Conference, Nov. 1998, Dallas, TX, USA; Sponsored by Psychonomics Society, USA
Contract(s)/Grant(s): NASA Order H-6689-I; RTOP 548-51-42; No Copyright; Avail: Issuing Activity; Abstract Only

Van Sergi, Ruthruff and Johnston found that dual-task practice can markedly reduce interference in the Psychological Refractory Period paradigm. Their results are consistent with a bottleneck model in which practice serves primarily to reduce stage durations. This model predicts that single-task practice on Task 1 alone should produce marked reductions in interference, whereas single-task practice on Task 2 should not. New experiments test these predictions. Alternative theoretical accounts are also considered.
Author
*Refractory Period; Models*

**20020065572** Virginia Univ., Charlottesville, VA USA
**Accelerated Tumor Cell Death by Angiogenic Modifiers** ***Annual Report, 15 Jul. 2000-14 Jul 2001***
Chung, Leland W.; Hsieh, Chia-Ling; Bradley, Michael; Sokoloff, Mitchell H.; Aug. 2001; 60p; In English
Contract(s)/Grant(s): DAMD17-00-1-0526
Report No.(s): AD-A403672; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Because of the inherent stability of endothelial cells and the importance of this cell type for the proliferation of both localized and disseminated cancers, anti- angiogenic therapy is an attractive target for the investigation and further development of novel therapeutic approaches to cancer metastasis. The purpose of this proposal is to assess molecular mechanism 5 underlying synergy between squalamine and vascular endothelial growth factor 5 (VEGF).
DTIC
*Endothelium; Metastasis; Death; Cancer*

**20020065573** Washington Univ., Saint Louis, MO USA
**An LOH Study of Chromosome 8 in Multiple Prostate Cancer Sibships** ***Annual Report, 1 Mar. 2000-31 Aug. 2001***
Suarez, Brian K.; Sep. 2001; 91p; In English
Contract(s)/Grant(s): DAMD17-00-1-0108
Report No.(s): AD-A403667; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This study is designed to identify one or more prostate cancer (CaP) tumor suppressor genes (TSO) on chromosome 8 by assessing the distribution of loss of HETEROZYGOSITY IN BROTHERS FROM MULTIPLEX SIBSHIPS. A strong linkage signal has been demonstrated in these families. The differential pattern of linkage disequilibrium between affected men and controls will be used to further narrow the region and the potential for epistatic interaction between a TSG and two non-chromosome S putative CaP susceptibility genes (HPC2/ELAC2 and the androgen receptor) will be assessed with methods currently under development. Scope: The region of interest is the entire short arm of chromosome S and a region from approximately D8S2324 to D8S592 on 8q. Major Findings: Although the genotyping is not yet complete, we find levels of LOH in our multiplex sample comparable to levels reported among unrelated men. The region of greatest LOH stretches from D8S277 to D8SlS25 and corresponds to the peak linkage signal.
DTIC
*Chromosomes; Genes; Cancer; Prostate Gland*

**20020065574** Scripps Research Inst., La Jolla, CA USA
**Antigene Strategy in Breast Cancer Therapy: Rationales for Direct Targeting of erbB2/Her2 DNA with Polyamides** ***Annual Report, 1 Sep. 2000-31 Aug. 2001***
Katritch, Vsevolod Y.; Sep. 2001; 12p; In English
Contract(s)/Grant(s): DAMD17-99-1-9323
Report No.(s): AD-A403668; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The major goal of this project is to design and computationally evaluate the most potent Pyrrole-Imidazole containing polyamide inhibitors of erbB2/Her2 transcription. In the first year of the project we used an original algorithm to identify the most suitable sequences within erbB2 promoter DNA to target with the polyamides. This year we focused our efforts on generating polyamides with high affinity and specificity to the target DNA sequences. Thus, we have developed an improved and extended version of our algorithm to build 3-Dimentional molecular models of polyamides bound into the minor groove of DNA. In this algorithm, a standard B-DNA model is used as initial conformation for double stranded DNA, and the polyamide chain is placed in the minor groove according to the specified polyamide-DNA pairing rules. Geometries of these initial conformations are energy optimized under special distance constraints, derived from the available polyamide-DNA x-ray structures. The improved approach provides reliable models for longer complexes and allows to include new elements into polyamide design. In addition we developed a fast method to introduce ”mismatches” into the DNA sequence of the model and evaluate their effect on affinity of the complex. Systematic study of DNA-polyamide complex with such mutations can be used to predict binding specificity.
DTIC
*Deoxyribonucleic Acid; Cancer; Polyamide Resins; Algorithms*

**20020065575** North Carolina Univ., Chapel Hill, NC USA
**The Use of Her2/neu-Specific Genetic Vaccines for the Prevention and Treatment of Breast Cancer** ***Annual Report, 1 Jul. 2000-30 Jun. 2001***
Tisch, Roland M.; Jul. 2001; 8p; In English
Contract(s)/Grant(s): DAMD17-98-1-8225
Report No.(s): AD-A403670; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
We are investigating the feasibility of using HER2/neu encoding genetic vaccines to induce potent CD4+ and CD8+ T cell reactivity for the prevention and treatment of breast cancer. Two strategies of genetic vaccination, each with distinct advantages will be assessed. The first strategy entails the use of alphavirus Venezuelan equine encephalitis virus (VEE)-replicons which selectively infect dendritic cells in vivo. Dendritic cells are characterized by a highly potent capacity to activate naive T cells. Our second strategy is to employ a plasmid DNA (pDNA) vaccine encoding HER2/neu. pDNA vaccination has been shown to be effective in eliciting persistent T cell reactivity in various experimental model systems. VEE-replicon and pDNA vaccines encoding cytokines such as lL-12 and lL-18 will be used to enhance anti-HER2/neu-specific CD4+ Th 1 cell and CD8+ CTL activity. to directly assess the efficacy of our approach to prevent tumor cell growth and/or eradicate established tumors, mice transgenic for a rat HER2/neu gene will be employed. These mice develop mammary tumors and pulmonary metastatic lesions. Furthermore, we will use mice transgenic for HLA-A2.1 to investigate CD8+ CTL responses to HER2/neu-specific peptide epitopes which have been proposed as targets for immunotherapy in a clinical setting.
DTIC
*Deoxyribonucleic Acid; Genetics; Vaccines; Cancer; Mammary Glands; Immune Systems*

**20020065576** Vermont Univ., Burlington, VT USA
**Identification of Small Ligands Targeting Breast Cancer by In Vivo Screening of Peptide Libraries in Breast Cancer Patients** ***Annual Report, 5 Aug. 2000-4 Aug 2001***
Krag, David N.; Sep. 2001; 89p; In English; Original contains color images
Contract(s)/Grant(s): DAMD17-99-1-9425
Report No.(s): AD-A403671; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
The purpose of this research is to develop methods of generating tumor specific small peptides that will bind to human cancers. The scope of this research is to construct peptide%displayed random peptide libraries as a source of peptide ligands that will target human cancers. An in vivo selection process will select ligands present in the library. Preclinical toxicity testing in a murine model is in the scope of this project and much of this work has been completed. The preclinical work in mice strongly supports the use of this technology in humans because the toxicity levels appear very low and because panning experiments have resulted in enrichment of peptide-phage clones that are likely tumor-specific. Phase I testing of detecting ligands in human cancer patients is within the scope of this research. Our preliminary data has led to approval by the FDA to proceed with human clinical study. We are prepared in this third year of grant support to safely enter patients into this clinical study. We will continue to develop methods related to evaluation of clones obtained from in vivo panning. We remain highly optimistic that peptides with significant affinity to tumors in breast cancer patients can be obtained.
DTIC
*Peptides; In Vivo Methods and Tests; Cancer; Bacteriophages*

**20020065577** Vanderbilt Univ., Medical Center, Nashville, TN USA

**Role of the Catenin p120 in Breast Cancer** ***Annual Report, 1 Sep. 2000-31 Aug. 2001***

Reynolds, Albert B.; Sep. 2001; 5p; In English

Contract(s)/Grant(s): DAMD17-99-1-9423

Report No.(s): AD-A403615; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Our working hypothesis is that induced p120 loss in the breast will impair E-cadherin function leading to (1) severe adverse consequences to lobular-alveolar development, and (2) positive effects on tumorigenesis or tumor progression leading to increased invasion and metastasis. to determine the role of p120 inactivation in breast cancer, we have proposed to study the consequences of targeted p120 loss of function in the mammary glands of normal and transgenic mouse models for tumorigenesis and metastasis. The first aim proposes to use gene targeting to incorporate loxp sites at strategic locations in the p120 gene such that Ore recombinase-induced deletion of the intervening sequence will inactivate p120. Mice containing this conditional allele (p120flox) will be generated and crossed with WAP-Cre mice to target the conditional deletion to the breast. Our major progress in this reporting period is successful testing of the Ore-induced recombination event in the targeting construct, and the generation of 397 ES cell lines, some of which appear to be expressing the homologously recombined floxed p120 allele. Thus, we anticipate successful generation of the p120 knockout mouse in the next six months. The mouse will be invaluable for studying further the role of p120 in metastasis and breast cancer.

DTIC

*Genes; Cancer; Cells (Biology); Metastasis; Mammary Glands*

**20020066167** PSI Technology Co., Andover, MA USA

**Recovery and Sequestration of CO(2) from Stationary Combustion Systems by Photosynthesis of Microalgae** ***Quarterly Report, 1 Oct. - 31 Dec. 2001***

Nakamura, T.; Olaizola, M.; Masutani, S. M.; Mar. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-794158; No Copyright; Avail: National Technical Information Service (NTIS)

Most of the anthropogenic emissions of carbon dioxide result from the combustion of fossil fuels for energy production. Photosynthesis has long been recognized as a means, at least in theory, to sequester anthropogenic carbon dioxide. Aquatic microalgae have been identified as fast growing species whose carbon fixing rates are higher than those of land-based plants by one order of magnitude. Physical Sciences Inc. (PSI), Aquasearch, and the Hawaii Natural Energy Institute at the University of Hawaii are jointly developing technologies for recovery and sequestration of CO2 from stationary combustion systems by photosynthesis of microalgae. The research is aimed primarily at demonstrating the ability of selected species of microalgae to effectively fix carbon from typical power plant exhaust gases. This report covers the reporting period 1 October to 31 December 2001 in which PSI, Aquasearch and University of Hawaii conducted their tasks. Based on the work conducted during the previous reporting period, PSI initiated work on the component optimization work. Aquasearch continued their effort on selection of microalgae suitable for CO2 sequestration. University of Hawaii initiated effort on system optimization of the CO2 sequestration system.

NTIS

*Photosynthesis; Carbon Dioxide; Exhaust Gases; Carbon Dioxide Removal; Algae*

**20020066392** American Ag-Tec International Ltd., Delavan, WI USA

**Space Age Spuds**

Spinoff 2000; 2000, pp. 55; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

American Ag-Tech International, Ltd. developed a system called Quantum Tubers through the Wisconsin Center for Space Automation and Robotics (a NASA-sponsored Commercial Space Center). Using computerization and technologies originally intended for growing plants in space, the company developed a growth chamber that accelerates plant growth and is free of plant pathogens. The chamber is used to grow minitubers, which serve as nuclear seed stock for potatoes. Using lighting technology, temperature and humidity controls, and automation technology, the minituber can be generated in one closed facility with out much labor handling. This means they can be grown year round in extreme environments. The system eliminates the need for multiple generations of seed and eliminates exposure to pathogens, disease and pests. The Quantum Tubers system can produce 10-20 million tubers throughout the year, about equal to the world's supply of this generation seed stock.

Author

*Vegetation Growth; Phytotrons; Technology Utilization; Potatoes; Germination*

**20020066431** Institute of Gas Technology, Des Plaines, IL USA

**Environmental Benign Mitigation of Microbiologically Influenced Corrosion (MIC)** ***Quarterly Report, Oct. - Dec. 2001***

Paterek, J. R.; Mar. 2002; 16p; In English

Report No.(s): DE2002-793996; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The overall program objective is to develop and evaluate environmental benign agents or products that are effective in the prevention, inhibition, and mitigation of microbially influenced corrosion (MIC) in the internal surfaces of metallic natural gas pipelines. The goal is one or more environmental benign, a.k.a. 'green' products that can be applied to maintain the structure and dependability of the natural gas infrastructure. The technical approach for this quarter has been to evaluate a number of real world pipeline sources for microbial communities or consortia that form biofilms under laboratory simulations of pipelines. The microorganisms will be identified using classical and molecular microbiological tools and there activities under pipeline simulating conditions will be studied. The quarter saw the collection of the first samples from the industry for isolation of the microorganisms, as well as the design and construction of the laboratory-scale pipeline simulators.

NTIS

*Pipelines; Microwaves; Microorganisms; Corrosion Prevention*

**20020066445** Geo-Centers, Inc., USA

**Preserving Fresh Fruit**

Spinoff 2000; 2000, pp. 52; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

Geo-Centers, Inc. has developed an Ethlyene Monitoring and Control System through an SBIR contract with Kennedy Space Center. As plants grow, they produce by products of ethylene and ammonia which are harmful to plant development. The system provides optimal exposure of fruit to ethylene since the proper balance in ethylene is necessary to prevent fruit loss. It can be used to monitor the de-greening process of citrus fruits, in particular.

Author

*Technology Utilization; Preserving; Fruits; Closed Ecological Systems*

**20020066566** NASA Marshall Space Flight Center, Huntsville, AL USA

**Desulfonatronum paiuteum sp. nov.: A New Alkaliphilic, Sulfate-Reducing Bacterium, Isolated from Soda Mono Lake, California**

Pikuta, Elena, Alabama Univ., USA; Hoover, Richard B., NASA Marshall Space Flight Center, USA; Marsic, Damien, Alabama Univ., USA; Whitman, William, Georgia Univ., USA; Cleland, David, American Type Culture Collection, USA; Krader, Paul, American Type Culture Collection, USA; [2002]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

A novel alkaliphilic, sulfate reducing bacterium strain MLF1(sup T) was isolated from sediments of soda Mono Lake, California. Gram-negative vibrion cells, motile by singular polar flagellum, with sizes 0.5 - 0.6x 1.2 - 2.0 micron occurred singly, in pairs or short spirilla. Growth was observed over the temperature range of +15 C to +48 C (optimum +37 C), NaCl concentration range is greater than 1 - 7 %, wt/vol (optimum 3 %, wt/vol) and pH range 7.8 - 10.5 (optimum pH 9.0 - 9.4). The novel isolate is strictly alkaliphilic, requires high carbonate concentration in medium, obligately anaerobic and catalase negative. As electron donors strain MLF1(sup T) uses hydrogen, formate, ethanol. Sulfate, sulfite, and thiosulfate (but not sulfur or nitrate) can be used as electron acceptors. The sole end product of growth on formate was H2S. Strain MLF1(sup T) is resistant to kanamycin and gentamycin, but sensitive to chloramphenicol and tetracycline. Na2MoO4 inhibits growth of strain MLF1(sup T). The sum of G+C in DNA is 63.1 mol% (by HPLC method). On the basis of physiological and molecular properties, the isolate was considered as novel species of genus Desulfonatronum; and the name Desulfonatronum paiuteum sp. nov., is proposed (type strain MLF1(sup T) = ATCC BAA-395(sup T) = DSMZ 14708(sup T).

Author

*Bacteria; Lakes; Alkalinity*

**20020066578** Department of Health and Human Services, Office of the Assistant Secretary for Planning and Evaluation, Washington, DC USA

**Physical Activity Fundamental to Preventing Disease**

Jun. 20, 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): PB2002-108104; No Copyright; Avail: National Technical Information Service (NTIS)

Regular physical activity, fitness, and exercise are critically important for the health and well being of people of all ages. Research has demonstrated that virtually all individuals can benefit from regular physical activity, whether they participate in vigorous exercise or some type of moderate health-enhancing physical activity. Even among frail and very old adults, mobility

and functioning can be improved through physical activity. Therefore, physical fitness should be a priority for Americans of all ages.
NTIS
*Physical Fitness; Medicine*

**20020066591** NASA Marshall Space Flight Center, Huntsville, AL USA
**Spirochaeta americana sp. nov.: A New Haloalkaliphilic, Obligately Anaerobic Spirochete Isolated from Soda Mono Lake, California**
Hoover, Richard B., NASA Marshall Space Flight Center, USA; Pikuta, Elena V., Alabama Univ., USA; Marsic, Damien, Alabama Univ., USA; Whitman, William B., Georgia Univ., USA; Tang, Jane, American Type Culture Collection, USA; Krader, Paul, American Type Culture Collection, USA; [2002]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

A novel obligately anaerobic, mesophilic, haloalkaliphilic spirochete, strain ASpG1, was isolated from sediments of the alkaline, hypersaline Mono Lake in California, U.S.A. The gram-negative cells are motile and spirochete-shaped with sizes of 0.22 x 10-15 micron. Growth was observed over the temperature range of 10 C to 44 C (optimum 37 C), NaCl concentration range of greater than 1 - 12 % (wt/vol) (optimum 3%), and pH range 7.5 - 10.5 (optimum pH 9.5). The novel isolate is strictly alkaliphilic, requires high concentrations of carbonate in the medium, and is capable of utilizing D-glucose, fructose, maltose, sucrose, starch, and D-mannitol. Main end products of glucose fermentation are: H2, acetate, ethanol, and formate. Strain AspG1 is resistant to kanamycin, but sensitive to chloramphenicol, gentamycin and tetracycline. The G+C content of its DNA is 58.5 mol%. On the basis of its physiological and molecular properties, the isolate appears to be a novel species among the genus Spirochaeta; and the name Spirochaeta americana sp. nov., is proposed for the taxon (type strain ASpG1(sup T) = ATCC BAA_392(sup T) = DSMZ 14872(sup T)).
Author
*Lakes; Mesophiles; Anaerobes; Sediments*

**20020066636** Wisconsin Univ., Lab. of Genetics, Madison, WI USA
**Molecular Genetics of Root Thigmoresponsiveness in Arabidopsis thaliana** ***Final Report, 1998-2002***
Masson, Patrick H., Wisconsin Univ., USA; [2002]; 12p; In English; Zip(TM) disk 100MB IBM-Compatible
Contract(s)/Grant(s): NAG2-1189
Report No.(s): NONP-NASA-DK-2002108422; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; A02, Diskette

The molecular mechanisms that allow plant roots to use gravity and touch as growth guides are investigated. We are using a molecular genetic strategy in Arabidopsis thaliana to study these processes. When Arabidopsis thaliana seedlings grow on tilted hard-agar surfaces, their roots develop a wavy pattern of growth which appears to derive from a succession of left-handed and right-handed circumnutation-like processes triggered by gravity and touch stimulation (Okada and Shimura, 1990; Rutherford et al., 1998; Rutherford and Masson, 1996). Interestingly, mutations that affect root waving on tilted hard-agar surfaces can be identified and characterized. Some of these mutations affect root gravitropism, while others appear to be responsible for the production of abnormal waves (no waves, compressed or square waves, coils) without affecting gravitropism. The specific objectives of this project were to functionally characterize two genes (WVD2 and WVD6) which are required for root waving on tilted agar surfaces, but not for root gravitropism. Specific objectives included a physiological and cytological analysis of the mutants, and molecular cloning and characterization of the corresponding genes. As summarized in this paper, we have reached these objectives. We have also identified and partially characterized other mutations that affect root skewing on hard-agar surfaces (sku5-1 and ago1), and have completed our work on the root-wave phenotype associated with mutations in genes of the tryptophan biosynthesis pathway (Lynn et al., 1999; Rutherford et al., 1998; Sedbrook et al., 2000, 2002). We briefly describe our progress on the cloning and characterization of WVD6, WVD2 and SKU5, and provide a list of papers (published, or in preparation) that derived from this grant. We also discuss the biological implications of our findings, with special emphasis on the analysis of WVD2.
Derived from text
*Biosynthesis; Cloning (Biology); Cytology; Genetics; Molecular Biology; Plants (Botany)*

**20020066645** NASA Marshall Space Flight Center, Huntsville, AL USA
**Determination of the Absolute Number of Cytokine mRNA Molecules within Individual Activated Human T Cells**
Karr, Laurel J., NASA Marshall Space Flight Center, USA; Marshall, Gwen, Alabama Univ., USA; Hockett, Richard D., Lilly (Eli) and Co., USA; Bucy, R. Pat, Alabama Univ., USA; [2002]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

A primary function of activated T cells is the expression and subsequent secretion of cytokines, which orchestrate the differentiation of other lymphocytes, modulate antigen presenting cell activity, and alter vascular endothelium to mediate an immune response. Since many features of immune regulation probably result from modest alterations of endogenous rates of multiple interacting processes, quantitative analysis of the frequency and specific activity of individual T cells is critically important. Using a coordinated set of quantitative methods, the absolute number of molecules of several key cytokine mRNA species in individual T cells has been determined. The frequency of human blood T cells activated in vitro by mitogens and recall protein antigens was determined by intracellular cytokine protein staining, in situ hybridization for cytokine mRNA, and by limiting dilution analysis for cytokine mRNA+ cells. The absolute number of mRNA molecules was simultaneously determined in both homogenates of the entire population of cells and in individual cells obtained by limiting dilution, using a quantitative, competitive RT-PCR assay. The absolute numbers of mRNA molecules in a population of cells divided by the frequency of individual positive cells, yielded essentially the same number of mRNA molecules per cell as direct analysis of individual cells by limiting dilution analysis. Mean numbers of mRNA per positive cell from both mitogen and antigen activated T cells, using these stimulation conditions, were 6000 for IL-2, 6300 for IFN-gamma, and 1600 for IL-4.
Author
*Assaying; Cells (Biology); Lymphocytes; Cardiovascular System; Ribonucleic Acids; Cytology*

**20020066661** NASA Ames Research Center, Moffett Field, CA USA
**Regulatory Mechanism of Muscle Disuse Atrophy in Adult Rats** ***Final Report, Nov. 1990 - Apr. 1993***
[1993]; 3p; In English
Contract(s)/Grant(s): NAG2-386; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

During the last phase of NAG 2-386 we completed three studies. The effects of 14 days of weightlessness; the vastus medialis (VM) from flight rats in COSMOS 2044 was compared with the VM from tail suspended rats and other controls. The type I and II fibers in the mixed fiber portion of the VM were significantly reduced in flight rats and capillary densities paralleled the fiber density changes. The results of this project compared favorably with those in the extensor digitorum longus following seven days of flight in SL 3. The cardiovascular projects focused on the blood pressure changes in head down tilted rats (HDT) and non-head down tilted (N-HDT) rats. Blood pressures (MAP, SP and DP) were significantly elevated through seven days of HDT and rapidly returned to control levels within one day after removal from the HDT position. The N-HDT showed some slight rise in blood pressure but these were not as great and they were not as rapid. The HDT rats were characterized as exhibiting transient hypertension. These results led to some of the microvascular and vascular graduate student projects of Dr. Bernhard Stepke. Also our results refute or, at least, do not agree with previous reports from other laboratories. Each animal, in our blood pressure projects, served as its own control thereby providing more accurate results. Also, our experiments focused on recovery studies which can, in and of themselves, provide guidelines for flight experiments concerned with blood pressure changes. Another experiment was conducted to examine the role of testicular atrophy in whole body suspended (WBS) and tail suspended (TS) rats. We worked in conjunction with Dr. D.R. Deaver's laboratory at Pennsylvania State University and Dr. R. P. Amann at Colorado State University. In the TS rats the testes are retracted into the abdominal cavity, unless a ligature is placed to maintain them in the external scrotal sac. The cryptorchid condition in TS rats results in atrophy of the testes and lowered levels of spermatid formation. Hormonal changes due to testes atrophy must be considered in future experiments where related effects may modify muscle, bone or other tissue changes. Also, some new assessments of past results (published by many researchers) may warrant revised interpretations. The blood pressure studies and the testicular function results were presented and reviewed during an invited lecture at the University of Bordeaux II during the Animals in Space Symposium in March 1993. In summary, each of these three projects complied with the objectives of the proposal and serve to demonstrate the utility of animal models in preparations and interpretations of space flight results. All funding has been expended in accordance with the approved budget.
Derived from text
*Rats; Physiological Tests; Physiological Effects; Weightlessness; Cardiovascular System*

**20020067414** Tuskegee Inst., Dept. of Agricultural Sciences, AL USA
**Sweetpotato Stem Cuttings Database in Preparation for Flight** ***Final Report***
Mortley, Desmond G., Tuskegee Inst., USA; [2002]; 3p; In English
Contract(s)/Grant(s): NAG10-0209; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Since 1985, Tuskegee University has been engaged in research that addresses NASA's mission to achieve long-duration human space exploration on the moon and Mars. The successful research of Dr. George Washington Carver, the beginning of our long history of working with crops for food and industrial uses, is well known. This history and contemporary technical expertise in food/industrial crops, and our interest in pursuing new, interdisciplinary approaches to education and research led us to submit a proposal to NASA in 1985 to pursue the hydroponic production of sweetpotato for food for astronaut-explorers on future

long-term, distant space missions. As a carbohydrate and dual vegetable (edible leaves), the versatile sweetpotato has the potential to be a key crop as a main source of energy and other nutrients such as beta-carotene, calcium and potassium. Sweetpotato is a crop very suited to space, as was documented in a monograph published by our scientists in 1984.
Derived from text
*Farm Crops; Hydroponics; Data Bases*

## 52
## AEROSPACE MEDICINE

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

**20020065430** California Univ., Molecular, Cellular and Integrative Physiology Interdepartmental Program, Los Angeles, CA USA
**Mechanical Signal Transduction in Countermeasures to Muscle Atrophy, *1 May 1998 - 30 Apr. 2002***
Tidball, James G., California Univ., USA; [2002]; 3p; In English
Contract(s)/Grant(s): NAG2-1193; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We have shown that modifications in muscle use result in changes in the expression and activity of calpains and nitric oxide synthase (NOS). Although muscle unloading for 10 days produced no change in the concentrations of calpain 1 or 2 and no change in calpain activation, muscle reloading produced a 90% increase in calpain 2 concentration. We developed an in vitro model to test our hypothesis that nitric oxide can inhibit cytoskeletal breakdown in skeletal muscle cells by inhibiting calpain cleavage of talin. Talin was selected because it is a well-characterized calpain substrate and it is codistributed with calpain in muscle cells. We found that intermittant loading during hindlimb suspension that is sufficient to prevent muscle mass loss that occurs during muscle unloading is also sufficient to prevent the decrease in NOS expression that normally occurs during hindlimb unloading. These findings indicate that therapeutics directed toward regulating the calpain/calpastatin system may be beneficial in preventing muscle mass loss in muscle injury, unloading and disease.
Author
*Muscles; Nitrogen Oxides; Hindlimb Suspension; Unloading*

**20020066321** National Inst. of Standards and Technology, American Dental Association Health Foundation, Gaithersburg, MD USA
**Formation and Conversion of Calcium Phosphates: A Novel Approach to Prevent Cavities and Dentin Sensitivity**
Tung, Ming S., National Inst. of Standards and Technology, USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 105-109; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A01, Hardcopy; A06, Microfiche

About 95 percent of the tooth enamel is inorganic calcium phosphate crystal, known as apatite. Dental cavities and dentin sensitivity are due to the dissolution or loss of the apatite crystal, demineralization. to prevent and heal these problems, the tooth mineral is deposited back to where it is lost by a novel process of rapid remineralization, the recrystallization of apatite. This is accomplished with a new, clinically feasible method: rapid formation on and in the tooth of amorphous calcium phosphates, which then crystallize to apatite slowly after application.' The highly concentrated calcium phosphate solutions are applied in two ways: two-step gel and one-step carbonated mouth rinse. Two-step application forms the calcium phosphate gel on the tooth by applying a calcium solution on the tooth followed by applying a phosphate solution. The one-step application rinses a carbonated calcium phosphate which is mixed before application.
Derived from text
*Calcium Phosphates; Dentistry; Amorphous Materials; Crystallization*

**20020066443** Computer Motion, Inc., Santa Barbara, CA USA
**Robotic Surgery**
Spinoff 2000; 2000, pp. 36-37; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

The Automated Endoscopic System for Optimal Positioning, or AESOP, was developed by Computer Motion, Inc. under a SBIR contract from the Jet Propulsion Lab. AESOP is a robotic endoscopic positioning system used to control the motion of a camera during endoscopic surgery. The camera, which is mounted at the end of a robotic arm, previously had to be held in place

by the surgical staff. With AESOP the robotic arm can make more precise and consistent movements. AESOP is also voice controlled by the surgeon. It is hoped that this technology can be used in space repair missions which require precision beyond human dexterity. A new generation of the same technology entitled the ZEUS Robotic Surgical System can make endoscopic procedures even more successful. ZEUS allows the surgeon control various instruments in its robotic arms, allowing for the precision the procedure requires.
Author
*Surgery; Robot Arms; Robotics; Technology Utilization*

**20020066501** OmniCorder Technologies, Inc., Stony Brook, NY USA
**Breast Cancer Detection**
Spinoff 2000; 2000, pp. 40; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

The BioScan System was developed by OmniCorder Technologies, Inc. at the Jet Propulsion Laboratory. The system is able to locate cancerous lesions by detecting the cancer's ability to recruit a new blood supply. A digital sensor detects infrared energy emitted from the body and identifies the minute differences accompanying the blood flow changes associated with cancerous cells. It also has potential use as a monitoring device during cancer treatment. This technology will reduce the time taken to detect cancerous cells and allow for earlier intervention, therefore increasing the overall survival rates of breast cancer patients.
Author
*Cancer; Detection; Infrared Radiation; Photometers; Sensors; Technology Utilization*

**20020066503** DelSys, Inc., Boston, MA USA
**Monitoring on the Move**
Spinoff 2000; 2000, pp. 38-39; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

The MyoMonitor EMG system was developed by Delsys, Inc. under SBIR funding from Johnson Space Center. It is a wearable four-channel device that can monitor muscle performance. Presently, its application include rehabilitative therapy, injury prevention, sports medicine, exercise training, and various other muscle monitoring activities. The MyoMonitor uses a two-bar single differential electrode. Due to the electrode-skin interface in traditional EMG equipment, during rigorous muscular activity, the movement of the skin causes the electrode detection surfaces to become compromised. The MyoMonitor eliminates this problem, enabling a wide array of applications and experiments during intense muscular activity. The ability to make such recordings, for example, enables novel experiments aboard the International Space Station for investigating the effect of microgravity on muscle performance. Product still commercially available as of March 2002.
Author
*Electromyography; Muscular Function; Therapy; Technology Utilization*

**20020066518** Academy of Sciences of the Ukraine, Research and Development Center of Fluid Mechanics, Kiev, Ukraine
**High Sustained G-Tolerance Model Development** ***Final Report, 1 Apr. 2001-23 Apr 2002***
Grygoryan, Rafik D.; Apr. 23, 2002; 62p; In English; Original contains color images
Contract(s)/Grant(s): STCU REGISTRATION NO; P-078
Report No.(s): AD-A403632; No Copyright; Avail: CASI; A04, Hardcopy

This report results from a contract tasking the National Academy of Sciences of Ukraine to develop and expand a computer model that simulates acceleration g-forces and g-effects on individuals. The model was made tunable to male/female individuals as well as individual with various pathologic conditions or physical states. It simulates the main hemodynamic characteristics both without and with use of artificial protection methods and tools. The main goal of model and software is to provide computer simulation experiments by physiologists and students.
DTIC
*Computerized Simulation; Physiology; Hemodynamic Responses; Tolerances (Physiology)*

**20020066607** Naval Postgraduate School, Monterey, CA USA
**The Effect of Sound Delivery Methods on a User's Sense of Presence in a Virtual Environment**
Sanders, Richard D., Jr.; Scorgie, Mark A.; Mar. 2002; 129p; In English; Original contains color images
Report No.(s): AD-A403676; No Copyright; Avail: CASI; A07, Hardcopy

The purpose behind this thesis was two-fold. First, the effect of sound delivery on a user's sense of presence in a virtual environment was investigated. Second, the physiological responses of electrodermal activity, heart rate, end temperature were

measured end correlated to the user's subjective sense of presence in an attempt to determine if physiological measures can be used in the future as en objective measure of presence. A computer based first-person shooter gene (Medal of Honor: Allied Assault(Trademark)) was utilized as the virtual environment. The independent variable wee sound delivery method (no sound, 5.1 surround sound, headphones, end headphones with subwoofer). The dependent variables were physiological response end questionnaire results. Results indicated that sound contributed to the user's sense of presence as evidenced by electrodermal activity and temperature end questionnaire scores. Also, significant changes occurred between the speaker end headphone sound delivery methods. This response suggests that speakers crested a higher sense of emotion and possibly induced a higher level of presence in participants.
DTIC
*Physiological Effects; Virtual Reality; Physiological Responses; Dependent Variables; Physiology*

**20020066678** Office of Air Quality Planning and Standards, Research Triangle Park, NC USA
**Air Toxics Pilot Study Laboratory Intercomparison: Quality Assurance Report**
Apr. 2002; In English; This document is color dependent and/or landscape layout. It is currently only available on CD-ROM and in paper copy
Report No.(s): PB2002-108217; EPA/454/R-02/004; No Copyright; Avail: National Technical Information Service (NTIS)
To address the concerns about the prevalence of air toxics emissions and to meet EPA's (Environmental Protection Agency) strategic goals, a national air toxics program has been designed to characterize, prioritize, and equitably address the impacts of Hazardous Air Pollutants (HAPs) on the public health and environment. The national air toxics program seeks to address air toxics problems through a combination of activities and authorities, including regulatory approaches and voluntary partnerships. One of the key activities is the National Air Toxics Assessment (NATA). NATA activities will help EPA identify areas of concern, characterize human health and ecosystem risks and track progress of trends. As outlined in the air toxics monitoring 'Concept Paper', the role of ambient monitoring is to support NATA activities includes: characterization of ambient concentrations and deposition in representative monitoring areas; provide data to support and evaluate dispersion and deposition models; and establish trends and evaluate the effectiveness of HAP reduction strategies.
NTIS
*Air Pollution; Trends; Toxic Hazards; Contaminants; Pollution Monitoring; Air Quality*

**20020066679** Trucking Research Inst., Alexandria, VA USA
**Study of Prevalence of Sleep Apnea among Commercial Truck Drivers** ***Final Report, Dec. 1993 - Dec. 2001***
Pack, A. I.; Dinges, D.; Maislin, G.; May 2002; 298p; In English
Report No.(s): PB2002-108226; FMCSA-RT-02-030; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche
The purpose of this study is: (1) to estimate the prevalence of sleep apnea among a high-risk sample of commercial drivers; (2) to examine the relationship in the high-risk sample between severity of sleep apnea and decrements in function related to driving tasks, and; (3) to develop a profile of the overall sample of commercial drivers with regard to their sleep apnea-related characteristics and risks. This study, involving overnight laboratory testing of more than 400 subjects, was one of the largest sleep apnea studies ever conducted on any population. It revealed that sleep apnea is common among commercial drivers, but not as prevalent as indicated in some previous reports.
NTIS
*Respiration; Operators (Personnel); Sleep; Wakefulness*

**20020067392** NASA Marshall Space Flight Center, Huntsville, AL USA
**Magnetic Microspheres for Therapeutical Applications**
Mazuruk, K., Universities Space Research Association, USA; Ramachandran, N., Universities Space Research Association, USA; [2002]; 1p; In English; SPIE Conference on Crystal Materials for Non-Linear Optics Devices and Microgravity Science, 18-22 Jul. 2002, Seattle, WA, USA; Sponsored by International Society for Optical Engineering, USA
Contract(s)/Grant(s): NCC8-66; No Copyright; Avail: Issuing Activity; Abstract Only
Hyperthermia is a well known cancer therapy and consists of heating a tumor region to the elevated temperatures in the range of 40-45 C for an extended period of time (2-8 hours). This leads to thermal inactivation of cell regulatory and growth processes with resulting widespread necrosis, carbonization and coagulation. Moreover, heat boosts the tumor response to other treatments such as radiation, chemotherapy or immunotherapy. of particular importance is careful control of generated heat in the treated region and keeping it localized. Higher heating, to about 56 C can lead to tissue thermo-ablation. With accurate temperature control, hyperthermia has the advantage of having minimal side effects. Several heating techniques are utilized for this purpose, such as whole body hyperthermia, radio-frequency (RF) hyperthermia, ultrasound technique, inductive microwave antenna

hyperthermia, inductive needles (thermoseeds), and magnetic fluid hyperthermia (MFH).MFH offers many advantages as targeting capability by applying magnets. However, this technology still suffers significant inefficiencies due to lack of thermal control. This paper will provide a review of the topic and outline the ongoing work in this area. The main emphasis is in devising ways to overcome the technical difficulty in hyperthermia therapy of achieving a uniform therapeutic temperature over the required region of the body and holding it steady. The basic obstacle of the present heating methods are non-uniform thermal properties of the tissue. Our approach is to develop a novel class of magnetic fluids which have inherent thermoregulating properties. We have identified a few magnetic alloys which can serve as a suitable nano-particle material. The objective is to synthesize, characterize and evaluate the efficacy of TRMF for hyperthermia therapy.
Author
*Hyperthermia; Therapy; High Temperature; Thermoregulation*

**20020067608** NASA Marshall Space Flight Center, Huntsville, AL USA
**Kinetic Studies of Human Pyruvate Dehydrogenase and Its Mutants: Interactions with TPP**
Patel, Mulchand S., State Univ. of New York, USA; Korotchkina, Lioubov G., State Univ. of New York, USA; Ciszak, Ewa, NASA Marshall Space Flight Center, USA; Jacobia, Scott J., NASA Marshall Space Flight Center, USA; Dominiak, Paulina, NASA Marshall Space Flight Center, USA; [2001]; 1p; In English; International Conference on Thiamin, its Biochemistry and Structural Biology, 18-21 May 2002, Newark, NJ, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The structure-function relationship and regulation of human pyruvate dehydrogenase (E1), the first component of the pyruvate dehydrogenase complex (PDC), was investigated by kinetic analysis of several mutant proteins. Two amino acid residues (alphaC62 and betaW135, based on mature protein numbering) predicted to be essential for the E1 function based on chemical modification, were found to be involved in protein stability and TPP-binding, though not directly. Several mutations identified in E1-deficient patients were analyzed: alphaH15, alphaM181, alphaP188, alphaR234, alphaR349. Substitutions H15R, H15Q, H15A, M181V and R234G increased apparent K(sub m), for TPP. The maximum increase (250-fold) was found for the substitution of M181, present in TPP-motif. R234Q mutation appeared to have no affect on TPP-binding as R-234G did, but decreased the rate of dephosphorylation of site 3, thus affecting, the amount of active PDC in the cell. Different substitution at three phosphorylation sites of human E1 (alphaS264, site 1; alphaS271, site 2; and alphaS203, site 3) demonstrated the differences in the mechanism of inactivation as a result of phosphorylation of each of the three sites. Site 1 phosphorylation could result in steric interference with E1 catalysis, while site 3 phosphorylation appears to interfere with TPP-binding. Four isoenzymes of pyruvate dehydrogenase kinase (PDK) showed different site-specificity towards three phosphorylation sites of E1. The complexity of E1 (and hence PDC) modulation is necessary for regulation of carbohydrate metabolism under different physiological conditions. Importance of the above amino acid residues in relation to their positions in the three-dimensional structure of human E1 will be discussed.
Author
*Phosphorylation; Pyruvates; Amino Acids; Proteins; Kinetics; Chemical Bonds*

**20020067638** NASA Marshall Space Flight Center, Huntsville, AL USA
**Structural Studies of Human Pyruvate Dehydrogenase**
Ciszak, Ewa, NASA Marshall Space Flight Center, USA; Korotchkina, Lioubov G., State Univ. of New York, USA; Dominiak, Paulina, NASA Marshall Space Flight Center, USA; Sidhu, Sukhdeep, State Univ. of New York, USA; Patel, Mulchand S., State Univ. of New York, USA; [2002]; 1p; In English; International Conference on Thiamin, Its Biochemistry and Structural Biology, 18-21 May 2002, Newark, NJ, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Human pyruvate dehydrogenase (E1) catalyzes the irreversible decarboxylation of pyruvate in the presence of Mg(2+) and thiamin pyrophosphate (TPP) followed by the rate-limiting reductive acetylation of the lipoyl moiety linked to dihydrolipoamide acetyltransferase. The three-dimensional structure of human E1 is elucidated using the methods of macromolecular X-ray crystallography. The structure is an alpha, alpha', beta and beta' tetramer with the protein units being in the tetrahedral arrangement. Each 361-residue alpha-subunit and 329-residue beta-subunit is composed of a beta-sheet core surrounded by alpha-helical domains. Each subunit is in extensive contact with all the three subunits involving TPP and magnesium cofactors, and potassium ions. The two binding sites for TPP are at the alpha-beta' and alpha'-beta interfaces, each involving a magnesium ion and Phe6l, His63, Tyr89, and Met200 from the alpha-subunit (or alpha'-subunit), and Met81 Phe85, His128 from the beta-subunit (or beta'-subunit). K+ ions are nestled between two beta-sheets and the end of an alpha-helix in each beta-subunit, where they are coordinated by four carbonyl oxygen groups from Ile12, Ala160, Asp163, and Asnl65, and a water molecule. The

catalytic C2 carbon of thiazolium ring in this structure forms a 3.2 A contact with a water molecule involved in a series of H-bonds with other water molecules, and indirectly with amino acids including those involved in the catalysis and regulation of the enzyme. Author

*Pyruvates; Magnesium; Metal Ions; Decarboxylation; Proteins; Amino Acids; Crystallography; X Ray Analysis; Potassium*

## 53
## BEHAVIORAL SCIENCES

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

**20020066283** Institute for Human Factors TNO, Soesterberg, Netherlands

**Teams Under Stress: The Influence of Individual and Team Factors on Performance, a Field-Study** ***Final Report Teams Onder Stress: Veldonderzoek naar de Involved Van Individuele-en Teamkenmerken Op Effectief Functioneren***

Fennis, M., Institute for Human Factors TNO, Netherlands; vanVliet, A. J., Institute for Human Factors TNO, Netherlands; Langefeld, J. J., Institute for Human Factors TNO, Netherlands; Feb. 11, 2002; 42p; In Dutch

Contract(s)/Grant(s): 013.18302; TNO Proj. 791.2

Report No.(s): TD-2001-0362; TNO-TM-02-A005; Copyright; Avail: Issuing Activity

By order of the Department of Behavioral Sciences of the Royal Dutch Army, a field study was carried out at military people on a peace-keeping mission. The aim of the study was to give insight in how individual and team factors influence the relationship between stress and performance, and to give recommendations on how to prevent negative consequences. Via questionnaires work factors, individual factors, team and morale factors were measured. Regression analysis showed that tension during the mission was explained by a combination of work factors (working conditions at home), individual factors (peoples' character), team factors (leadership style, group cohesion) and moral factors (faith in weapons and colleagues and a clear responsibility). Differences in performance were explained by the work factor: work stress before leaving, the individual factors: attachment with 'home', support from home, the person's character "openness to new experiences", and coping styles, the team factors: leadership style and group support and the moral factors: commitment to the mission and, again, a clear responsibility. Results confirmed our model: individual as well as team factors do indeed moderate the relationship between stress and performance. Explicitly trainable competencies such as leadership style, team cohesion and coping styles may reduce the negative effects of operating in stressful circumstances. Because of the importance of support from home, a well-developed information campaign may be of great importance.

Author

*Human Performance; Regression Analysis; Teams; Stress (Psychology); Psychological Factors; Social Factors*

**20020066560** Institute for Human Factors TNO, Soesterberg, Netherlands

**New Version of Disorientation Demonstration and Night Vision Demonstration** ***Final Report Desorientie Demonstratie "Nieuwe Stijl" en Nachtzicht Demonstratie***

Groen, E. L., Institute for Human Factors TNO, Netherlands; Hop, R., Institute for Human Factors TNO, Netherlands; Bles, W., Institute for Human Factors TNO, Netherlands; Kooi, F. L., Institute for Human Factors TNO, Netherlands; deGraaf, B., Institute for Human Factors TNO, Netherlands; Apr. 03, 2002; 70p; In Dutch; Original contains color illustrations

Contract(s)/Grant(s): 013.30361; TNO Proj. 789.3

Report No.(s): TD-2001-0375; TM-02-A018; Copyright; Avail: Issuing Activity

The purpose of this report was to investigate how the disorientation demonstration (DESODEMO) that Toegepast Natuurwetenschappelijk Onderzoek Human Factors (TNO-HF) organizes for military student aviators may be combined with the disorientation simulator Airfox DISO of the Aeromedical Institute (AMI). The report describes the contents and philosophy of the disorientation demonstration at TNO-HF, and gives a review of the disorientation illusions that can be simulated with the Airfox DISO of the AMI. A selection of illusions will be implemented in the DESODEMO program. The report also shows how the Airfox DISO may be used for night vision demonstration. The DESODEMO is a particularly useful aspect in the elementary training of aviators. The course is given in the vestibular laboratory that is suitable to provide insight in mainly vestibular disorientation mechanisms. However, the equipment has a rather abstract nature so that the aviators may have to transfer their experiences to a flight environment. In this respect the Airfox DISO has the advantage that it places the aviator in a cockpit and also shows flight related visual illusions, In daylight and night vision circumstances. An important conclusion in this report is that the optics of the Airfox DISO can easily be made night vision goggles friendly. We have placed the necessary filters, which makes

it already possible to demonstrate basic elements of night vision equipment. For a more advanced demonstration an upgrade of the DISO's visual database is required.
Author
*Training Simulators; Human Factors Engineering; Aircraft Pilots; Disorientation; Computer Programs; Night Vision*

**20020066663** NASA Ames Research Center, Moffett Field, CA USA
**Cockpit Interruptions and Distractions: An Analysis of ASRS Reports and an Experimental Program**
Dismukes, R. K., NASA Ames Research Center, USA; Young, Grant E., NASA Ames Research Center, USA; [1998]; 1p; In English; 10th International Journal of Aviation Psychology, 2-6 May 1999, Columbus, OH, USA
Contract(s)/Grant(s): RTOP 505-64-53-49-48; No Copyright; Avail: Issuing Activity; Abstract Only

A recent detailed analysis of 107 ASRS incident reports focusing on interruptions and distractions as their primary feature revealed several interesting and surprising findings. of those tasks that were interfered with, over 40% fell within the category of monitoring; for example, monitoring the autopilot flying the aircraft, monitoring the pilot flying, or monitoring the altimeter or navigation instruments for future action. Surprisingly, over 60% of the tasks that were considered distractions fell under the broad category of communication or conversation. Using these findings, we have developed an experimental paradigm that will help us understand the method by which pilots perform certain monitoring tasks. Specifically, we hope to determine the degree to which pilots rely on internal time mechanisms versus external cues as a means of successfully completing a monitoring task. In addition, we will incorporate a battery of competing aviation type tasks, including communication, to see how these tasks affect the process of monitoring. The long range goal of this research is to find operational solutions that facilitate effective monitoring in the presence of both sudden interruptions and distractions that lead to unintended multiple tasks situations.
Author
*Cockpits; Interruption; Automatic Pilots; Aircraft Pilots*

## 54
## MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

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

**20020065540** NASA Ames Research Center, Moffett Field, CA USA
**Employing Simulation to Evaluate Designs: The APEX Approach**
Freed, Michael A., NASA Ames Research Center, USA; Shafto, Michael G., NASA Ames Research Center, USA; Remington, Roger W., NASA Ames Research Center, USA; Jul. 14, 1998; 14p; In English; European Conference on Human Computer Int., 14 Sep. 1998, Herkalean, Greece
Contract(s)/Grant(s): RTOP 548-40-12; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The key innovations of APEX are its integrated approaches to task analysis, procedure definition, and intelligent, resource-constrained multi-tasking. This paper presents a step-by-step description of how APEX is used, from scenario development through trace analysis.
Derived from text
*Computerized Simulation; Air Traffic Control; Control Systems Design; Systems Integration*

**20020066396** RJDesigns & Associates, Panama City, FL USA
**A New Lift for Those Who Need It**
Spinoff 2000; 2000, pp. 46-47; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

The eZ-uP device was designed by NASA engineer, Paul Neal, who worked with Kennedy Space Center. He took his idea to RJDesigns & Associates. With refinements, they developed a lightweight aluminium structure to assist the elderly in lifting themselves from seated positions. It can support people in excess of 500 pounds and is quickly assembled without tools. It is completely adjustable to fit under most sofas, chairs, and beds and will not slip on wood or tile floors. Also, it is relatively inexpensive compared to other products on the market. The apparatus is placed under the seat and adjusted so that the hand supports are in front of the person just under shoulder level. The seated person then takes hold and easily lifts himself from the seat. Product still commercially available as of March 2002.
Author
*Technology Utilization; Lifts; Seats*

**20020066446** Aerospace Design and Development, Inc., Niwot, CO USA

**Emergency Response Breathing Apparatus**

Spinoff 2000; 2000, pp. 44; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

Aerospace Design & Development, Inc.'s (ADD's) SCAMP was developed under an SBIR contract through Kennedy Space Center. SCAMP stands for Supercritical Air Mobility Pack. The technology came from the life support fuel cell support systems used for the Apollo and Space Shuttle programs. It uses supercritical cryogenic air and is able to function in microgravity environments. SCAMP's self-contained breathing apparatus(SCBA) systems are also ground-based and can provide twice as much air than traditional SCBA's due to its high-density capacity. The SCAMP system was designed for use in launch pad emergency rescues. ADD also developed a protective suit for use with SCAMP that is smaller and lighter system than the old ones. ADD's SCAMP allows for body cooling and breathing from the supercritical cryogenic air, requiring no extra systems. The improvement over the traditional SCBA allows for a reduction of injuries, such as heat stress, and makes it easier for rescuers to save lives.

Author

*Breathing Apparatus; Cryogenic Equipment; Portable Life Support Systems; Emergency Life Sustaining Systems; Technology Utilization*

**20020066454** Naval Postgraduate School, Monterey, CA USA

**An Exploratory Analysis on the Effects of Human Factors on Combat Outcomes**

Ching, Wan S.; Mar. 2002; 105p; In English; Original contains color images

Report No.(s): AD-A403526; No Copyright; Avail: CASI; A06, Hardcopy

The ongoing revolution in military affairs is transforming the nature of warfare. Modern combat systems are increasingly more effective yet more complex to operate. Nonetheless, their complexities cannot be compared to human behaviors which remain the most important factor in combat. Within Project Albert, an agent-based model called SOCRATES has been developed to enable users to explore the emergent behaviors of the agents. A deep operation scenario is developed to explore the effects of human factors on combat outcomes. Two experimental designs are used in this investigation: A Latin Hypercube and a Full-Factorial Design. Using the computing facilities at NPS, MITRE and MHPCC (Maui High Performance Computing Center), a total of 174,960 runs are made. The data suggest the existence of emergent patterns, and provide some insights into the question of how much more capable a smaller force must be in order to effectively battle a larger force. In addition, the analysis shows that the Latin Hypercube Design is able to identify the same significant factors in the scenario as are obtained by the Factorial Design, but with much fewer runs.

DTIC

*Human Factors Engineering; Factorial Design; Hypercube Multiprocessors*

**20020066599** Institute for Human Factors TNO, Soesterberg, Netherlands

**Thermal Comfort of Cotton, Woollen and Synthetic Underwear *Final Report Thermisch Comfort van Katoenen, Wollen en Synthetisch Ondergoed***

Daanen, H. A. M., Institute for Human Factors TNO, Netherlands; denHartog, E. A., Institute for Human Factors TNO, Netherlands; Brandsma, M. G., Institute for Human Factors TNO, Netherlands; Feb. 06, 2002; 19p; In Dutch; Original contains color illustrations

Contract(s)/Grant(s): 013.10313; TNO Proj. 789.2

Report No.(s): TD-2001-0363; TM-02-A004; Copyright; Avail: Issuing Activity

The Clothing and Personal Equipment Office of the Netherlands Defence Organization has asked TNO Human Factors to investigate the thermal comfort properties of cotton, woollen (50% wool, 50%. thermovyl) and synthetic underwear (polypropylene). The request included monitoring of sweat transport and temperature gradients through clothing. Eleven subjects participated in three sessions, one for each type of underwear (T-shirt and long pants) with the combat suit over it. The subjects performed 40 minutes of moderate exercise in a 10 C climatic chamber. Hereafter, they passively cooled down for 60 minutes. The subjects and clothing were weighed before, during and after the experiment to determine the sweat loss, absorption and evaporation. Four thermocouples were placed on the skin, two on the underwear and two on the combat suit to determine the skin temperature and temperature gradients of clothing. Thermal comfort was rated according to ISO 10551. Also, humidity sensation and overall comfort were rated. At the end of the exercise period the sweat loss averaged about 250 g. About 18 g was absorbed in the cotton underwear and only 8 g in the synthetic underwear. The cotton combat suit contained 22 g with the synthetic underwear underneath and only 12 g with cotton underwear. This means that 30 g or 12% is absorbed and 220 g or 88% is evaporated at the end of exercise. The data of the woollen underwear fall in between cotton and polypropylene. Most sweat is

evaporated at the end of the rest period. No differences were found in skin temperature, underwear temperature and clothing temperature. These temperatures are partly determined by insulation, moisture transfer properties, absorption heat and evaporation heat of the clothing. These processes may counteract and thus the temperatures may not reflect the results on water absorption. Since humans do not possess humidity sensors in the skin, comfort perception is strongly dependent on skin temperature. Therefore, no differences in thermal comfort were observed between the underwear types. It is possible, however, that a synthetic combat suit may change the results on temperature and comfort sensation due to different material properties. Author

*Moisture; Thermal Comfort; Sweat; Body Temperature; Comfort; Temperature Gradients; Clothing*

**20020066601** Institute for Human Factors TNO, Soesterberg, Netherlands

**Differential Pilot Selection Based on Body Dimensions** ***Interim Report Differentiele Selectie van Vliegers op Basis van Lichaamsmaten***

Oudenhuijzen, A. J. K., Institute for Human Factors TNO, Netherlands; May 06, 2002; 8p; In Dutch; Original contains color illustrations

Contract(s)/Grant(s): 013.30373; TNO Proj. 789.1

Report No.(s): TD-2002-0094; TM-02-A024; Copyright; Avail: Issuing Activity

A pilot for the Royal Netherlands Air Force (RNLAF) has to fulfil many requirements. One set of requirements is about the pilot's physical dimensions: he/she has to fit in the cockpit and has to be able to reach to various controls and to have an adequate view in and outside the cockpit. Today, (too) many Dutch candidate pilots are rejected because they are too tall or too small. Therefore, it is necessary to check the validity of the requirements and to correct them if needed and were possible. Two fixed sets of criteria are currently used for pilot selection, one for planes and one for helicopters. Once selected, all helicopter pilots have to be able to fly all helicopters operated by the RNLAF. All pilots for planes have to be able to fly all planes. However, not all cockpits are similar in size. A certain cockpit may be restrictive for long legs and, another cockpit may fit pilots with long legs. The selection criteria will become too restrictive as a result: all candidates have to fit all planes or helicopters. An option is to select pilots for one or two specific planes/helicopters in order to minimize the number of rejected pilots. Several cockpits were analysed in order to determine the selection criteria. These studies were performed using 3-dimensional digital human modelling systems. These systems are able to create 3-dimensional digital models of humans, called manikins, in various sizes. These manikins can be placed in computer models of the cockpit, and pilot fit can be analysed. Only a limited number of aircraft, operated by the RNLAF, were analysed, i.e. the most critical ones (the F16, the Cougar, and the Apache). It was found that the criteria used previously were too strict for the Apache, it was possible to select 16% more male pilots only for the Apache. In order to maximize the number of candidate pilots we recommend to analyse the remaining planes and helicopters in order to create a detailed set of criteria for all planes and helicopters operated by the RNLAF. Today, the selection criteria used are very accurate. A taller or smaller candidate is automatically rejected. However, it is possible that a somewhat smaller or taller candidate will fit due to his or her specific body properties. It is advised to test these candidates individually using TNO Human Factors 3-dimensional scanning technique in combination with computer models of the cockpit of the planes/helicopters operated by the RNLAF. Author

*Human Factors Engineering; Anthropometry; Pilot Selection; Computerized Simulation; Cockpits*

**20020066602** Institute for Human Factors TNO, Soesterberg, Netherlands

**Building Situation Awareness by A Moving UAV Operator** ***Final Report De Opbouw van Situationeel Bewustzijn Door een Bewegende UAV-Operator***

Jansen, C., Institute for Human Factors TNO, Netherlands; deVries, S. C., Institute for Human Factors TNO, Netherlands; May 27, 2002; 20p; In Dutch; Original contains color illustrations

Contract(s)/Grant(s): 013.31315; TNO Proj. 788.1

Report No.(s): TD-2002-0098; TNO-TM-020A027; Copyright; Avail: Issuing Activity

The study investigates spatial situational awareness of a moving UAV operator. If a co-pilot/gunner operates an Unmanned Aerial Vehicle (UAV), the co-pilot/gunner's visual and vestibular perception of movements of his own aircraft may hinder correct interpretation of spatial information presented (visually) by the UAV sensor. At the same time, having multiple viewpoints may enhance spatial situational awareness. A literature study has been performed on the effects of above mentioned factors to form a spatial situational awareness of the moving UAV operator, for the preparation of experimental research. If vestibular information is available in addition to visual information about one's movement, not only is spatial information perceived more accurately, spatial situational awareness is enhanced as well. Also, multiple viewpoints contribute to building spatial situational awareness. An experiment should reveal whether spatial information from both perspectives is integrated in one viewpoint-independent

frame of reference, or whether vestibular information concerning one perspective results in two separate frames of reference (or some intermediate form).
Author
*Motion Perception; Remotely Piloted Vehicles; Situational Awareness; Proprioception; Operators (Personnel); Flying Personnel*

**20020066786** NASA Ames Research Center, Moffett Field, CA USA
**Discriminability of Prediction Artifacts in a Time Delayed Virtual Environment**
Adelstein, Bernard D., NASA Ames Research Center, USA; Jung, Jae Y., NASA Ames Research Center, USA; Ellis, Stephen R., NASA Ames Research Center, USA; March 2001; 6p; In English
Contract(s)/Grant(s): RTOP 131-20-30
Report No.(s): NASA/TM-2001-210912; NAS 1.15:210912; IH-017; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Overall latency remains an impediment to perceived image stability and consequently to human performance in virtual environment (VE) systems. Predictive compensators have been proposed as a means to mitigate these shortcomings, but they introduce rendering errors because of induced motion overshoot and heightened noise. Discriminability of these compensator artifacts was investigated by a protocol in which head tracked image stability for 35 ms baseline VE system latency was compared against artificially added (16.7 to 100 ms) latency compensated by a previously studied Kalman Filter (K-F) predictor. A control study in which uncompensated 16.7 to 100 ms latencies were compared against the baseline was also performed. Results from 10 subjects in the main study and 8 in the control group indicate that predictive compensation artifacts are less discernible than the disruptions of uncompensated time delay for the shorter but not the longer added latencies. We propose that noise magnification and overshoot are contributory cues to the presence of predictive compensation.
Author
*Cues; Errors; Human Performance; Predictions; Stability; Time Lag*

**20020067405** Old Dominion Univ., Research Foundation, Norfolk, VA USA
**Personality as it Relates to Decision Making, Information Processing and Error Management in Commercial Aviation *Final Report***
Davis, Donald, Old Dominion Univ., USA; Mihalecz, Michael C., Old Dominion Univ., USA; [2002]; 2p; In English
Contract(s)/Grant(s): NGT1-52230; ODURF Proj. 102521; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Progress has been made on ”Personality as it relates to decision making, information processing and error management in commercial aviation” in several areas during the first phase of the project.
Derived from text
*Data Processing; Decision Making; Personality; Errors*

## 59
## MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

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

**20020065558** Utah Univ., Salt Lake City, UT USA
**Symposium on Adaptive Methods for Partial Differential Equations *Final Report***
Pernice, M.; Johnson, C. R.; Smith, P. J.; Fogelson, A.; Dec. 10, 1998; 38p; In English
Report No.(s): DE2002-761679; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Complex physical phenomena often include features that span a wide range of spatial and temporal scales. Accurate simulation of such phenomena can be difficult to obtain, and computations that are under-resolved can even exhibit spurious features. While it is possible to resolve small scale features by increasing the number of grid points, global grid refinement can quickly lead to problems that are intractable, even on the largest available computing facilities. These constraints are particularly severe for three dimensional problems that involve complex physics. One way to achieve the needed resolution is to refine the computational mesh locally, in only those regions where enhanced resolution is required. Adaptive solution methods concentrate computational effort in regions where it is most needed. These methods have been successfully applied to a wide variety of problems in computational science and engineering. Adaptive methods can be difficult to implement, prompting the development of tools and environments to facilitate their use. to ensure that the results of their efforts are useful, algorithm and tool developers must maintain close communication with application specialists. Conversely it remains difficult for application specialists who

are unfamiliar with the methods to evaluate the trade-offs between the benefits of enhanced local resolution and the effort needed to implement an adaptive solution method.
NTIS
*Conferences; Partial Differential Equations; Computational Grids*

**20020065559** Argonne National Lab., IL USA
**Spectrum of Applications of Automated Reasoning**
Wos, L.; Jan. 06, 2002; 18p; In English
Report No.(s): DE2002-41736; DE-W-31-109-ENG-38; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The likelihood of an automated reasoning program being of substantial assistance for a wide spectrum of applications rests with the nature of the options and parameters it offers on which to base needed strategies and methodologies. This article focuses on such a spectrum, featuring W. McCune's program OTTER, discussing widely varied successes in answering open questions, and touching on some of the strategies and methodologies that played a key role. The applications include finding a first proof, discovering single axioms, locating improved axiom systems, and simplifying existing proofs. The last application is directly pertinent to the recently found (by R. Thiele) Hilbert's twenty-fourth problem--which is extremely amenable to attack with the appropriate automated reasoning program, a problem concerned with proof simplification. The methodologies include those for seeking shorter proofs and for finding proofs that avoid unwanted lemmas or classes of term, a specific option for seeking proofs with smaller equational or formula complexity, and a different option to address the variable richness of a proof. The type of proof one obtains with the use of OTTER is Hilbert-style axiomatic, including details that permit one sometimes to gain new insights. We include questions still open and challenges that merit consideration.
NTIS
*Mathematical Logic; Simplification; Applications Programs (Computers)*

**20020066630** Argonne National Lab., Mathematics and Computer Science Div., IL USA
**Reducing the Memory Requirement in Reverse Mode Automatic Differentiation by Solving TBR Flow Equations**
Naumann, U.; 2002; 14p; In English
Report No.(s): DE2002-41754; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The fast computation of gradients in reverse mode Automatic Differentiation (AD) requires the generation of adjoint versions of every statement in the original code. Due to the resulting reversal of the control flow certain intermediate values have to be made available in reverse order to compute the local partial derivatives. This can be achieved by storing these values or by recomputing them when they become required. In any case one is interested in minimizing the size of this set. Following an extensive introduction of the 'To-Be-Recorded' (TBR) problem the authors present flow equations for propagating the TBR status of variables in the context of reverse mode AD of structured programs.
NTIS
*Flow Equations; Partial Differential Equations; Memory (Computers); Structured Programming*

## 60
## COMPUTER OPERATIONS AND HARDWARE

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

**20020066494** DAAT Research Corp., Hanover, NH USA
**Designing Cool Components**
Spinoff 2000; 2000, pp. 71; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

A NASA SBIR contract served as the beginning for the development of Daat Research Corporation's Coolit software. Coolit is a unique computational fluid dynamics (CFD) application aimed at thermal and cooling design problems. Coolit can generate 3-D representations of the thermofluid environment and "sketch" the component on the computer. The software modeling reduces time and effort in prototype building and testing.
Author
*Technology Utilization; Applications Programs (Computers); Thermal Simulation; Computer Aided Design*

**20020066655** NASA Marshall Space Flight Center, Huntsville, AL USA

**Hardware Evolution of Closed-Loop Controller Designs**

Gwaltney, David, NASA Marshall Space Flight Center, USA; Ferguson, Ian, Jet Propulsion Lab., California Inst. of Tech., USA; [2002]; 1p; In English; 2002 NASA/DOD Conference on Evolvable Hardware, 15-18 Jul. 2002, Alexandria, VA, USA; Sponsored by NASA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Poster presentation will outline on-going efforts at NASA, MSFC to employ various Evolvable Hardware experimental platforms in the evolution of digital and analog circuitry for application to automatic control. Included will be information concerning the application of commercially available hardware and software along with the use of the JPL developed FPTA2 integrated circuit and supporting JPL developed software. Results to date will be presented.

Author

*Controllers; Evolvable Hardware; Feedback Control; Design Analysis*

## 61
## COMPUTER PROGRAMMING AND SOFTWARE

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

**20020065270** SRI International Corp., Computer Science Lab., Menlo Park, CA USA

**Formally Verified Hardware Encapsulation Mechanism for Security, Integrity, and Safety** ***Final Report, Aug. 1996-Nov. 2001***

Rushby, John; Apr. 2002; 292p; In English

Contract(s)/Grant(s): F30602-96-C-0204; DARPA Order D855; AF Proj. D855

Report No.(s): AD-A403303; AFRL-IF-RS-TR-2002-85; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

Safety- and security-critical systems both require encapsulation of code and data belonging to different applications and sensitivity levels. It must be impossible for a fault or Trojan Horse in one application to affect the operation or real-time performance of another, or for information of one sensitivity level to contaminate that of another. Encapsulation is achieved by the combination of software in an operating system kernel managing hardware protection mechanisms. The critical nature of the applications concerned means that extremely high assurance is required for the correctness of the encapsulation mechanisms. A systematic approach is developed for the formal specification and verification of these encapsulation properties and mechanisms, addressing the interaction between a processor, custom protection hardware, and the kernel software managing them; it encompasses both safety and security concerns and may be adjusted for different classes of systems. It is validated by mechanically checked verification. This validation provides a formal guarantee -- from kernel interface down through hardware -- of both spatial (memory) and temporal (time-slicing) encapsulation for the processor.

DTIC

*Security; Warning Systems; Program Verification (Computers); Kernel Functions*

**20020065294** Naval Postgraduate School, Monterey, CA USA

**Web-Based Collaboration Technology and Requirements for Peace Operations**

Spivey, Madalyn A.; Mar. 2002; 63p; In English; Original contains color images

Report No.(s): AD-A403520; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Peace Operations include Peace Making, Peace Building, and Peace Support. Although information-sharing systems may exist within individual organizations, to date no interoperable information regime exists that can link all players who participate in providing aid during a Complex Humanitarian Emergency. Effective information sharing between civilian and military organizations is needed to enhance operational efficiencies, therefore saving lives, resources, and promoting rapid recuperation and reconstruction. An off-the-shelf collaborative software package with a common architecture and common templates, standard protocols, and centralized database might initially serve as a collaboration platform. Extensible Markup Language (XML), XML-based languages, and Resource Description Framework (RDF) are important technologies that must be utilized extensively to enable this environment. Additionally, WebDAV(Web-based Distributed Authoring and Versioning) integration can provide an infrastructure for platform-neutral asynchronous collaborative authoring via the Internet. Internationalization (I18N) and localization (L10N) addresses differences in language requirements and local expectations that reflect our differences in cultures. Existing collaboration COTS architectures form a basis with which developers can integrate XML technologies. The ”ideal” collaborative environment must include asynchronous and synchronous collaboration capabilities, as well as capabilities that will

enable users to rapidly locate personnel, organize and conduct virtual teams and meetings, provide information delivery to personnel, and provide sufficient security mechanisms.
DTIC
*Information Systems; Internets; Document Markup Languages; Applications Programs (Computers); Data Bases*

**20020065316** Pittsburgh Univ., Pittsburgh, PA USA
**Innovative Statistical Approaches to Modeling Multiple Data from the NSABP BCPT** ***Annual Report, 1 Sep. 2000-31 Aug. 2001***
Weissfeld, Lisa A.; Berhane, Kiros; Sep. 2001; 196p; In English
Contract(s)/Grant(s): DAMD17-99-1-9356
Report No.(s): AD-A403334; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche
The goals of this IDEA award are two-fold, namely, to develop and refine statistical methodology for the analysis of a data set where multiple outcomes or disease incidence endpoints are of interest and to apply these methods to the analysis of a data set in prevention such as the National Surgical Adjuvant Breast and Bowel Project's Breast Cancer Prevention Trial. The software for the fitting of the B-spline models, the first type of model that was proposed in this study is now being used to fit these models and the simulation studies are also complete. Software development for the pseudospline approach is nearly complete. Extensions to the analysis of recurrent event data outcomes are now being developed.
DTIC
*Computerized Simulation; Statistical Analysis; Cancer*

**20020065337** Alabama Univ., Dept. of Mathematical Sciences, Huntsville, AL USA
**Basic Skills Trainer Simulation Improvements** ***Final Report, 29 Sep. 2000-31 Mar. 2002***
Dow, Stephen J.; May 22, 2002; 6p; In English
Contract(s)/Grant(s): DAAH01-97-D-R005
Report No.(s): AD-A403425; UAH-5-21171; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
The set of SED Basic Skills Trainers use common software for moving 30 target models over a background terrain. This report documents several improvements made to that software to provide greater realism, specifically antialiasing to smooth the borders between target and terrain, target hazing to better color-correct the targets based on their range, and improvements to the target orientation interpolation to provide smooth turns.
DTIC
*Computerized Simulation; Training Devices; Three Dimensional Models; Signal Processing*

**20020065425** California Univ., Davis, CA USA
**The Ariel Distributed Programming Project: Secure Execution of Mobile Programs** ***Final Report, May 1997-Nov. 2000***
Pandey, Raju; Apr. 2002; 13p; In English
Contract(s)/Grant(s): F30602-97-1-0221; DARPA ORDER-F208; AF Proj. F208
Report No.(s): AD-A403638; AFRL-IF-RS-TR-2002-87; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Initially, the primary goal of the project was to develop techniques for making systems safe from mobile programs. During the course of the project, several important results were achieved in security, resource scheduling, runtime system design, and distributed programming environments. These results include an access control specification language, novel tools and techniques for enforcing security policies, safe threads package, resource scheduling algorithms for protecting against denial of service attacks, dynamic Java virtual machine, dynamically configurable security policy systems, and an adaptive distributed programming environment.
DTIC
*Software Engineering; Security; Access Control; Programming Environments; Proving*

**20020065447** Defence Science and Technology Organisation, Weapons Systems Div., Fishermans Bend, Australia
**A Bayesian Track-before-Detect Algorithm for IR Point Target Detection**
Warren, Robert C., Defence Science and Technology Organisation, Australia; February 2002; 20p; In English
Report No.(s): DSTO-TR-1281; DODA-AR-012-164; Copyright; Avail: Issuing Activity
An algorithm has been developed for the detection of point targets in uncluttered background based on a Bayesian track before detect method. The algorithm has an application in the detection of sea skimming antiship missiles at maximum range, when the missile appears over the horizon. Because of the long range, angular motion of the target will be insignificant, and target motion cannot be used to aid detection. The effect of filtering with a number of spatial filters on detection efficiency is assessed. The

algorithm was tested on an infrared image sequence of an aircraft approaching the sensor at low level over water with a diffuse cloud background, and it was found to perform significantly better than simple detection by threshold exceedance. The algorithm is intended for application on a massively parallel processor where each pixel is assigned to a processing element, and each pixel is considered to be an individual sensor.
Author
*Algorithms; Target Acquisition; Parallel Processing (Computers); Massively Parallel Processors; Infrared Imagery*

**20020065460** Ballistic Missile Defense Organization, Washington, DC USA
**Open Systems Deployment Plan**
Aug. 30, 1996; 6p; In English
Report No.(s): AD-A403630; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
Historically, many weapon systems have been developed in closed environments that do not encourage use of many Commercial Off-The-Shelf (COTS) products and/or Non-Developmental Items (NDI) The use of proprietary hardware and software by systems developers was (and still is in some cases) the norm. This approach has led to increased life cycle cost of systems and a missed opportunity to capitalize on openly developed advanced commercial technologies and products. Including open systems products in a system design is a means of implementing the recommendations of Department of Defense (DoD) Technical Architecture initiatives. The Joint Technical Architecture (JTA) Version 1.0 provides a basis to deploy an open systems approach and should be referenced during all phases of system development.
DTIC
*Computer Programs; Systems Engineering; Software Engineering; Closed Ecological Systems*

**20020065465** Florida Univ., Dept. of Computer and Information Sciences, Gainesville, FL USA
**Change Detection in XML Documents of Differing Levels of Structural Verbosity in Support of Ubiquitous Data Access**
Lanham, Michael J.; May 15, 2002; 96p; In English; Original contains color images
Report No.(s): AD-A403563; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
Extensible markup Language (XML) and difference algorithms help mobile computing devices achieve interoperability with each other. XML provides applications a non-proprietary means of communicating among each other. Difference algorithms allow transferring only changes to files, not entire changed files. This research focuses on customizing current XML difference algorithms. The goal is to detect differences between two XML files that do not necessarily share the same structure. Small devices are generally incapable of presenting and processing parts of multi-media documents. They also have less memory and storage space than desktop units have. The sending device reduces transmission time by removing those contents, and other large embedded objects, from the data stream. The user can edit the streamlined file on the mobile device. Transmitting on the changes to this edited file conserves bandwidth, connection time, and battery-power. Integrating the transmitted changes back into the originating complex document becomes a fundamental requirement and a significant challenge.
DTIC
*Data Flow Analysis; Programming Languages; Change Detection; Memory (Computers)*

**20020065516** NASA Ames Research Center, Moffett Field, CA USA
**A Visual Detection Learning Model**
Beard, Bettina L., NASA Ames Research Center, USA; Ahumada, Albert J., Jr., NASA Ames Research Center, USA; [1998]; 1p; In English; Optical Society of America Conference, 4-7 Oct. 1998, USA
Contract(s)/Grant(s): RTOP 548-50-12; Copyright; Avail: Issuing Activity; Abstract Only
Our learning model has memory templates representing the target-plus-noise and noise-alone stimulus sets. The best correlating template determines the response. The correlations and the feedback participate in the additive template updating rule. The model can predict the relative thresholds for detection in random, fixed and twin noise.
Author
*Random Noise; Targets; Additives*

**20020065525** Science Applications International Corp., Thermal Analysis and Information Systems Division, Torrance, CA USA
**A Thermal Management Systems Model for the NASA GTX RBCC Concept** ***Final Report, 1 Apr. 1999 - 30 Apr. 2001***
Traci, Richard M., Science Applications International Corp., USA; Farr, John L., Jr., Science Applications International Corp., USA; Laganelli, Tony, Science Applications International Corp., USA; June 2002; 95p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAS3-99147; RTOP 708-90-63
Report No.(s): NASA/CR-2002-211587; NAS 1.26:211587; E-13372; SAIC-284-002-017; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The Vehicle Integrated Thermal Management Analysis Code (VITMAC) was further developed to aid the analysis, design, and optimization of propellant and thermal management concepts for advanced propulsion systems. The computational tool is based on engineering level principles and models. A graphical user interface (GUI) provides a simple and straightforward method to assess and evaluate multiple concepts before undertaking more rigorous analysis of candidate systems. The tool incorporates the Chemical Equilibrium and Applications (CEA) program and the RJPA code to permit heat transfer analysis of both rocket and air breathing propulsion systems. Key parts of the code have been validated with experimental data. The tool was specifically tailored to analyze rocket-based combined-cycle (RBCC) propulsion systems being considered for space transportation applications. This report describes the computational tool and its development and verification for NASA GTX RBCC propulsion system applications.

Author

*Aerothermodynamics; Rocket-Based Combined-Cycle Engines; Temperature Control; Aerospace Planes; Mathematical Models; Applications Programs (Computers)*

**20020065535** NASA Ames Research Center, Moffett Field, CA USA

**Fragmented Land Cover Types and Estimation of Area with Course Spatial Resolution Imagery**

Hlavka, Chris, NASA Ames Research Center, USA; Dungan, Jennifer, California State Univ., USA; [1998]; 1p; In English; 3rd International Symposium on Spatial Accuracy Assessment in Natural Resources and Enviornmental Sciences, 20 - 22 May 1998, Quebec City, Quebec, Canada

Contract(s)/Grant(s): RTOP 274-52-81-19; No Copyright; Avail: Issuing Activity; Abstract Only

Imagery of coarse resolution, such weather satellite imagery with 1 sq km pixels, is increasingly used to monitor dynamic and fragmented types of land surface types, such as scars from recent fires and ponds in wetlands. Accurate estimates of these land cover types at regional to global scales are required to assess the roles of fires and wetlands in global warming, yet difficult to compute when much of the area is accounted for by fragments about the same size as the pixels. In previous research, we found that size distribution of the fragments in several example scenes fit simple two-parameter models and related effects of coarse resolution to errors in area estimates based on pixel counts. We report on progress to develop accurate area estimates based on modelling the size distribution of the fragments, including analysis of size distributions on an expanded set of maps developed from digital imagery and a test of a procedure to correct for effects of coarse spatial resolution.

Author

*Satellite Imagery; Remote Sensing; Terrain*

**20020065539** MCAT Inst., USA

**Recent Progress on the Parallel Implementation of Moving-Body Overset Grid Schemes**

Wissink, Andrew, MCAT Inst., USA; Aug. 07, 1998; 1p; In English; 4th Symposium on Overset Composite Grid and Solution Technology, 23-25 Sep. 1998, Aberdeen Proving Ground, MD, USA

Contract(s)/Grant(s): NAS2-14109; RTOP 581-10-12; No Copyright; Avail: Issuing Activity; Abstract Only

Viscous calculations about geometrically complex bodies in which there is relative motion between component parts is one of the most computationally demanding problems facing CFD researchers today. This presentation documents results from the first two years of a CHSSI-funded effort within the U.S. Army AFDD to develop scalable dynamic overset grid methods for unsteady viscous calculations with moving-body problems. The first pan of the presentation will focus on results from OVERFLOW-D1, a parallelized moving-body overset grid scheme that employs traditional Chimera methodology. The two processes that dominate the cost of such problems are the flow solution on each component and the intergrid connectivity solution. Parallel implementations of the OVERFLOW flow solver and DCF3D connectivity software are coupled with a proposed two-part static-dynamic load balancing scheme and tested on the IBM SP and Cray T3E multi-processors. The second part of the presentation will cover some recent results from OVERFLOW-D2, a new flow solver that employs Cartesian grids with various levels of refinement, facilitating solution adaption. A study of the parallel performance of the scheme on large distributed- memory multiprocessor computer architectures will be reported.

Author

*Computational Fluid Dynamics; Computational Grids; Architecture (Computers)*

**20020065542** NASA Ames Research Center, Moffett Field, CA USA

**Sensor Spatial Distortion, Visual Latency, and Update Rate Effects on 3D Tracking in Virtual Environments**

Ellis, S. R., NASA Ames Research Center, USA; Adelstein, B. D., California Univ., USA; Baumeler, S., Zurich Univ., Switzerland; Jense, G. J., TNO Environment, Energy and Process Innovation, Netherlands; Jacoby, R. H., Sterling Software, Inc., USA; [1998]; 4p; In English; IEEE/VR Conference, Mar. 1999, Houston, TX, USA

Contract(s)/Grant(s): RTOP 199-06-12; No Copyright; Avail: Issuing Activity; Abstract Only

Several common defects that we have sought to minimize in immersing virtual environments are: static sensor spatial distortion, visual latency, and low update rates. Human performance within our environments during large amplitude 3D tracking was assessed by objective and subjective methods in the presence and absence of these defects. Results show that 1) removal of our relatively small spatial sensor distortion had minor effects on the tracking activity, 2) an Adapted Cooper-Harper controllability scale proved the most sensitive subjective indicator of the degradation of dynamic fidelity caused by increasing latency and decreasing frame rates, and 3) performance, as measured by normalized RMS tracking error or subjective impressions, was more markedly influenced by changing visual latency than by update rate.

Author

*Human Performance; Controllability; Defects; Virtual Reality; Virtual Properties*

**20020065543** NASA Ames Research Center, Moffett Field, CA USA

**Automatic Vortex Core Detection**

Kenwright, David, MRJ Technology Solutions, Inc., USA; Haimes, Robert, MRJ Technology Solutions, Inc., USA; [1998]; 1p; In English

Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-72; No Copyright; Avail: Issuing Activity; Abstract Only

An eigenvector method for vortex identification has been applied to recent numerical and experimental studies in external flow aerodynamics. This paper shows that it is an effective way to extract and visualize features such as vortex cores, spiral vortex breakdowns, and vortex bursts. The algorithm has also been incorporated in a finite element flow solver to guide an automatic mesh refinement program. Results show that this approach can resolve small scale vortical structures in helicopter rotor simulations which are not captured on coarse meshes.

Author

*Cores; Vortices; Detection; Eigenvectors; Aerodynamics; Grid Generation (Mathematics)*

**20020065551** Argonne National Lab., IL USA

**ELIS 8 Transportation Model**

Braun, M. D.; Van Groningen, C. N.; Feb. 13, 2002; 70p; In English

Report No.(s): DE2002-793087; ANL/DIS/02-1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Enhanced Logistics Intratheater Support Tool (ELIST) Version 8 is a software tool designed to allow military analysts to model the deployment of cargo and personnel into theaters of operation from ports of debarkation through staging areas and theater-staging bases to in-theater destinations, usually tactical assembly areas. This document defines the parameters and heuristics to be modeled. All design and implementation decisions are derived from this document. Validation and verification of the model are based on this document.

NTIS

*Heuristic Methods; Transportation; Mathematical Models*

**20020065555** Argonne National Lab., IL USA

**Software Test Plan/Description/Report (STP/STD/STR) for the Enhanced Logistiics Intratheater Support Tool (ELIST) Global Data Segment Version 8.1.0.0, Database Instance Segment Version 8.1.0.0, Database Fill Segement Version 8.1.0.0, Database Segem**

Feb. 26, 2002; 110p; In English

Report No.(s): DE2002-793096; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This document is the Software Test Plan/Description/Report (STP/STD/STR) for the DII COE Enhanced Logistics Intratheater Support Tool (ELIST) mission application. It combines in one document the information normally presented separately in a Software Test Plan, a Software Test Description, and a Software Test Report; it also presents this information in one place for all the segments of the ELIST mission application. The primary purpose of this document is to show that ELIST

has been tested by the developer and found, by that testing, to install, deinstall, and work properly. The information presented here is detailed enough to allow the reader to repeat the testing independently.
NTIS
*Performance Tests; Computer Programs; Installation Manuals*

**20020065569** MRJ Technology Solutions, Inc., USA
**Feature Detection in Linked Derived Spaces**
Henze, Chris, MRJ Technology Solutions, Inc., USA; [1998]; 1p; In English; IEEE Visualization 1998 Conference, 18-23 Oct. 1998; Sponsored by Institute of Electrical and Electronics Engineers, USA
Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-72; No Copyright; Avail: Issuing Activity; Abstract Only

This paper describes by example a strategy for plotting and interacting with data in multiple metric spaces. The example system was designed for use with time-varying computational fluid dynamics (CFD) datasets, but the methodology is directly applicable to other types of field data. The central objects embodied by the tool are {\em portraits}, which show the data in various coordinate systems, while preserving their spatial connectivity and temporal variability. The coordinates are derived in various ways from the field data, and an important feature is that new and derived portraits can be created interactively. The primary operations supported by the tool are brushing and linking: the user can select a subset of a given portrait, and this subset is highlighted in all portraits. The user can combine highlighted subsets from an arbitrary number of portraits with the usual logical operators, thereby indicating where an arbitrarily complex set of conditions holds. The system is useful for exploratory visualization and feature detection in multivariate data.
Author
*Computational Fluid Dynamics; Applications Programs (Computers); Coordinates; Metric Space; Data Management; Plotting*

**20020066265** Institute for Human Factors TNO, Soesterberg, Netherlands
**Future Developments: A SCORM Compliant IMAT System** ***Interim Report Toekomstige Ontwikkelingen: Een SCORM Compliant IMAT Systeem***
Veerman A. L., Institute for Human Factors TNO, Netherlands; Veldhuis, G. J., Institute for Human Factors TNO, Netherlands; Jacobs, L. R. M. A., Physics and Electronics Lab. TNO, Netherlands; Strijker, A., Physics and Electronics Lab. TNO, Netherlands; May 29, 2002; 50p; In Dutch
Contract(s)/Grant(s): 013.31339; TNO Proj. 790.1
Report No.(s): TD-2002-0099; TNO-TM-02-A028; Copyright; Avail: Issuing Activity

For the progression of IMAT it is important to establish relationships with international standardization initiatives. In the past, IMAT was focused on the IMS Global Learning Consortium and the European initiative Ariadne. Recently, from both initiatives parts were already integrated in the ADL/SCORM initiative. The current question is how IMAT fits in the most recent ADL/SCORM standardization developments, which discrepancies can be signalled, how they can be handled and what consequences they do imply. This report starts with a conceptual description of both IMAT and ADL/SCORM. Goals and backgrounds of both initiatives will be elaborated. Subsequently, a comparison will be made between the final IMAT specifications (version 'P-final') and the most recently published ADL/SCORM specifications (version 1.2). Based on the comparison interpretations will be given with respect to further adjustments of IMAT towards ADL/SCORM, and conclusions will be drawn. The results are to convert IMAT towards a SCORM 'compliant' system. The most important addition will be an extra module in relation to the IMAT database. The estimated effort of this work package depends on the granularity of the material. IMAT can be converted according to the SCORM specifications with relatively simple adjustments. An immediate start of this process, in which IMAT P-final will be turned into a SCORM-compliant version of IMAT requires some minimal adjustments and will result in a version which will be easily adjustable in the future.
Author
*Systems Compatibility; Systems Engineering; Data Bases; Distributed Processing*

**20020066309** Sandia National Labs., Albuquerque, NM USA
**Visual Empirical Region of Influence Pattern Recognition Tool for Leave-One-Out Data Analysis**
Martinez, R. F.; Mar. 2002; In English
Report No.(s): DE2002-020702; SAND2002-0702; No Copyright; Avail: National Technical Information Service (NTIS)

In previous research at Sandia National Laboratories new pattern recognition (PR) algorithms based on a human visual perception model were developed. We named these algorithms Visual Empirical Region of Influence (VERI) algorithms. This document describes a graphical user interface tool developed to control the VERI algorithm and a visualization technique that allows users to graphically animate and visually inspect multi-dimensional data after it has been classified by the VERI algorithms.

The VERI Interface Tool was written using the TcVTk Graphical User Interface (GUI) programming language, version 8.1. Although the TcVTk packages are designed to run on multi- platforms, we have concentrated our efforts to develop a user interface for the ubiquitous DOS environment.
NTIS
*Pattern Recognition; Visual Perception; Numerical Analysis; Data Processing*

**20020066391** Reticular Systems, Inc., San Diego, CA USA
**Agent Building Software**
Spinoff 2000; 2000, pp. 59; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

AgentBuilder is a software component developed under an SBIR contract between Reticular Systems, Inc., and Goddard Space Flight Center. AgentBuilder allows software developers without experience in intelligent agent technologies to easily build software applications using intelligent agents. Agents are components of software that will perform tasks automatically, with no intervention or command from a user. AgentBuilder reduces the time and cost of developing agent systems and provides a simple mechanism for implementing high-performance agent systems.
Author
*Technology Utilization; Software Development Tools; Knowledge Based Systems; Artificial Intelligence*

**20020066394** CFD Research Corp., Huntsville, AL USA
**Complicated Geometry**
Spinoff 2000; 2000, pp. 73; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

Using NASA SBIR funding, CFD Research Corporation has developed CFD-GEOM, an extension of traditional computer-aided drawing (CAD) software. CFD-GEOM can provide modeling and interactivity of computational fluid dynamics (CFD) latest field, mesh-generation and allows for quick and easy updating of a grid in response to changes in the CAD model.
Author
*Technology Utilization; Computer Aided Design; Grid Generation (Mathematics); Computational Grids; Applications Programs (Computers)*

**20020066455** Naval Postgraduate School, Monterey, CA USA
**Linux, OpenBSD, and Talisker: A Comparative Complexity Analysis**
Smith, Kevin R.; Mar. 2002; 153p; In English; Original contains color images
Report No.(s): AD-A403525; No Copyright; Avail: CASI; A08, Hardcopy

Security engineering requires a combination of features and assurance to provide confidence that security policy is correctly enforced. Rigorous engineering principles are applicable across a broad range of systems. The purpose of this study is to analyze and compare three operating systems, including two general-purpose operating systems (Linux and OpenBSD) and a commercially available, embedded operating system (Talisker). The basis for the comparison considers secure software design principles, such as information hiding, hierarchical structuring, and modularity, as well as software complexity metrics, such as the McCabe Cyclomatic Complexity and the number-of-lines-of-code. In this analysis, we use a reverse engineering tool to show how the three operating systems compare to each other with respect to the qualities of a secure operating system design. The operating systems, their kernels, and their scheduling subsystems are analyzed and compared. From the results, it is shown that the OpenBSD operating system, kernel, and scheduler are the best when considering hierarchical structuring, modularity, and information hiding. The Linux kernel and scheduler and the Talisker operating system are least complex when considering the McCabe complexity and the number-of-lines-of-code.
DTIC
*Computer Programs; UNIX (Operating System); Systems Engineering; Design Analysis; Kernel Functions*

**20020066476** Prevision, Inc., San Rafael, CA USA
**Software Sleuth**
Spinoff 2000; 2000, pp. 65; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

NASA's need to trace mistakes to their source to try and eliminate them in the future has resulted in software known as Root Cause Analysis (RoCA). Fair, Isaac & Co., Inc. has applied RoCA software, originally developed under an SBIR contract with

Kennedy, to its predictive software technology. RoCA can generate graphic reports to make analysis of problems easier and more efficient.
Author
*Technology Utilization; System Failures; Error Analysis; Fault Tolerance*

**20020066546** Swedish Defence Research Establishment, Div. of Systems Technology, Stockholm, Sweden
**The Need of SILVA from 2001** ***Behovsinventering av SILVIA 2001***
Hansson, M. B.; Jun. 2001; 34p; In Swedish
Report No.(s): PB2002-104669; FOI-R-0117-SE; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
It is important that SILVA is treated not as the one model that solves all the needs. There are needs of air defense models that SILVA does not cover, neither should. Therefore it is important to look at all the needs and to decide what needs SILVA should cover. There are some gray zones that SILVA could be built to cover or be chosen not to. The need of air defense models should be met from more than one model of different levels. Today we do lack a model for system structure planning, i.e. models that cover not particular systems but types of systems on a higher abstraction level. There is also a need of models that cover the survival of the protected object. SILVA is a tool to assess air defense systems on a technical level in tactical environment. The kernel is assessment of systems in a 'real' environment. The model has during the past years gone through many cycles of development which shows that SILVA is a living tool, but the years also show that SILVA is not built for this constantly changing process that the need causes. I.E. takes too long to make a simulation.
NTIS
*Air Defense; Assessments; Simulation; Survival*

**20020066588** Argonne National Lab., Mathematics and Computer Science Div., IL USA
**SPINning Parallel Systems Software**
Matlin, O. S.; Lusk, E.; McCune, W.; 2002; 24p; In English
Report No.(s): DE2002-42204; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
We describe our experiences in using Spin to verify parts of the Multi Purpose Daemon (MPD) parallel process management system. MPD is a distributed collection of processes connected by UNIX network sockets. MPD is dynamic processes and connections among them are created and destroyed as MPD is initialized, runs user processes, recovers from faults, and terminates. This dynamic nature is easily expressible in the Spin/Promela framework but poses performance and scalability challenges. We present here the results of expressing some of the parallel algorithms of MPD and executing both simulation and verification runs with Spin.
NTIS
*Parallel Programming; Software Engineering; Algorithms; Computer Networks*

**20020066604** Microcosm Technologies, Inc., Raleigh, NC USA
**Flume Computer-Aided Design (CAD): Integrated CAD for Microflume Components and Systems** ***Final Report, Jun. 1998-Jun 2001***
Gilbert, John R.; Deshpande, Manish; Apr. 2002; 184p; In English; Original contains color images
Contract(s)/Grant(s): F30602-98-2-0151; Proj-E118
Report No.(s): AD-A403586; AFRL-IF-RS-TR-2002-77; No Copyright; Avail: CASI; A09, Hardcopy
This effort was aimed at developing a computer-aided design (CAD) system to allow start-to-finish design of a broad class of micromechanical fluid systems. The NetFlow program, previously completed under DARPA funding, developed the capability to model the diverse transport phenomena that are present in micromechanical systems. FlumeCAD extends this toolkit to include simulation of active components as well as providing the capability to extract behavior models. Tools for simulating the entire device at the full time domain system level were also developed. All original milestones were met and the FlumeCAD software has been successfully released commercially.
DTIC
*Computer Aided Design; Transport Properties; Micromechanics; Extraction*

**20020066612** California Univ., Lawrence Berkeley National Lab., Environmental Energy Technologies Div., Berkeley, CA USA
**Exploration of Cache Behavior Using HPSS Per-File Transfer Logs**
Meyer, N.; Andrews, M.; Cholia, S.; Hazen, D.; Hurlbert, W.; Nov. 2001; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-793764; LBNL-49330; No Copyright; Avail: National Technical Information Service (NTIS)

We assembled 18 months of transfer logs from a production High Performance Storage System (HPSS) system at the National Energy Research Scientific Computing Center (NERSC) and analyzed them to assess workload behavior and gain some insight into which cache configurations would provide the best service to the users. We found, as expected, that the workload is distributed over file size with a declining number of files as the files get larger, so the amount of space consumed per file size increment is roughly constant up to file sizes of 1 GB. Sixty one percent of file accesses were write accesses. There are a significant number of files written which are never read backup files and similar files. For all sizes of files, access frequencies decline with the age of the files. HPSS uses the cache as an I/O buffer for incoming data. At our installation the cache behavior is dominated by the write traffic. Cache lifetimes tend to scale linearly with the size of the cache and inversely with the amount of data flow.
NTIS
*Computer Networks; Workloads (Psychophysiology); Data Transmission; Memory (Computers); Information Flow*

**20020066614** Technical Research Centre of Finland, Electronics, Espoo, Finland
**Testing of Object-Oriented Software. Utilisation of the UML in Testing**
Kaerki, M.; 2001; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): PB2002-105688; VTT-TIED-RN-2092; Copyright; Avail: National Technical Information Service (NTIS)
The modern software development requires more efficient production methods than ever before. It has been recognized that benefits can be obtained in software development by using object-orientation. Testing, however, has gained less attention, although it is still an important task in the software development to achieve such goals as finding errors and quality. The goal of this paper is to study how object-orientation affects testing as well as how the testing techniques that are adapted for object-orientation can be used for test design purposes. Utilization of the Unified Modeling Language (UML) in testing is introduced, and some practical solutions to avoid the obstacles of the testing of object-oriented software are addressed as well. Moreover, these solutions are combined and a test automation system (test driver implementation), which makes it easier to test the object-oriented software, is presented. Finally, the testing techniques that are studied, are applied to a demonstration systems, which is designed and implemented by using a CASE tool called Rhapsody. As Rhapsody provides its own impact to testing and test design, it is shown how the various UML diagrams are used for test design purposes in the context of Rhapsody.
NTIS
*Object-Oriented Programming; Performance Tests; Computer Programming*

**20020066660** MCAT Inst., Moffett Field, CA USA
**A Unified Overset Grid Generation Graphical Interface and New Concepts on Automatic Gridding Around Surface Discontinuities**
Chan, William M., MCAT Inst., USA; Aug. 06, 2002; 1p; In English; 4th Symposium on Overset Composite Grid and Solution Technology, 23-25 Sep. 1998, Aberdeen Providing Ground, MD, USA; Sponsored by Army Research Lab., USA
Contract(s)/Grant(s): NAS2-14109; RTOP 581-10-12; No Copyright; Avail: Issuing Activity; Abstract Only
For many years, generation of overset grids for complex configurations has required the use of a number of different independently developed software utilities. Results created by each step were then visualized using a separate visualization tool before moving on to the next. A new software tool called OVERGRID was developed which allows the user to perform all the grid generation steps and visualization under one environment. OVERGRID provides grid diagnostic functions such as surface tangent and normal checks as well as grid manipulation functions such as extraction, extrapolation, concatenation, redistribution, smoothing, and projection. Moreover, it also contains hyperbolic surface and volume grid generation modules that are specifically suited for overset grid generation. It is the first time that such a unified interface existed for the creation of overset grids for complex geometries. New concepts on automatic overset surface grid generation around surface discontinuities will also be briefly presented. Special control curves on the surface such as intersection curves, sharp edges, open boundaries, are called seam curves. The seam curves are first automatically extracted from a multiple panel network description of the surface. Points where three or more seam curves meet are automatically identified and are called seam corners. Seam corner surface grids are automatically generated using a singular axis topology. Hyperbolic surface grids are then grown from the seam curves that are automatically trimmed away from the seam corners.
Author
*Grid Generation (Mathematics); Computational Grids; Control Surfaces; Graphical User Interface*

**20020066671** NASA Ames Research Center, Moffett Field, CA USA
**NASA's Participation in the National Computational Grid**
Feiereisen, William J., NASA Ames Research Center, USA; [1998]; 1p; In English; Workshop on Clusters and Computational

Grids for Scientific Computing, 1 - 4 Sep. 1998, Knoxville, TN, USA
Contract(s)/Grant(s): RTOP 509-10-31; No Copyright; Avail: Issuing Activity; Abstract Only

Over the last several years it has become evident that the character of NASA's supercomputing needs has changed. One of the major missions of the agency is to support the design and manufacture of aero- and space-vehicles with technologies that will significantly reduce their cost. It is becoming clear that improvements in the process of aerospace design and manufacturing will require a high performance information infrastructure that allows geographically dispersed teams to draw upon resources that are broader than traditional supercomputing. A computational grid draws together our information resources into one system. We can foresee the time when a Grid will allow engineers and scientists to use the tools of supercomputers, databases and on line experimental devices in a virtual environment to collaborate with distant colleagues. The concept of a computational grid has been spoken of for many years, but several events in recent times are conspiring to allow us to actually build one. In late 1997 the National Science Foundation initiated the Partnerships for Advanced Computational Infrastructure (PACI) which is built around the idea of distributed high performance computing. The Alliance lead, by the National Computational Science Alliance (NCSA), and the National Partnership for Advanced Computational Infrastructure (NPACI), lead by the San Diego Supercomputing Center, have been instrumental in drawing together the "Grid Community" to identify the technology bottlenecks and propose a research agenda to address them. During the same period NASA has begun to reformulate parts of two major high performance computing research programs to concentrate on distributed high performance computing and has banded together with the PACI centers to address the research agenda in common.

Author

*Supercomputers; Computer Networks; Computational Grids; Information Retrieval; Architecture (Computers)*

**20020066675** NASA Ames Research Center, Moffett Field, CA USA

**What Determines the Response: Test or Reference?**

Chukova, S. V., Pavlov Inst. of Physiology, Russia; Ahumada, A. J., Jr., NASA Ames Research Center, USA; [1998]; 1p; In English; European Conference on Visual Perception, 24-28 Aug. 1998, Oxford, UK
Contract(s)/Grant(s): RTOP 505-65-53; No Copyright; Avail: Issuing Activity; Abstract Only

The stability of sensory memory has been studied by presenting a reference stimulus, a delay, and a test stimulus. As has been pointed out by Lages and Treisman (1998 Vision Research 38 557-572), the usual measure of performance depends only on the effect of test variations on the responses. The Weber fraction characterizing performance is more properly called the test stimulus Weber fraction. We measure the relative contribution of the test and reference to the response by the ratio of the test Weber fraction to the reference Weber fraction. The stimuli were two dark lines on a bright background. Seven reference separations, varying from 9.5 to 16.7 arc min, were intermixed in each run. Interstimulus intervals (ISI) of 50, 200 and 2000 msec and intertrial intervals (ITI) of 500 and 2500 msec were investigated. When the ISI was short (50 or 200 msec), for both ITIs, responses were determined equally by the test and reference. For the long ISI (2000 msec), the reference stimulus contributed less. However, only for the 500 msec ITI (and not for all observers) was the contribution of the reference stimulus negligible, as Treisman's criterion setting theory might suggest.

Author

*Visual Acuity; Psychological Tests; Visual Observation; Visual Stimuli; Visual Discrimination*

**20020066705** Massachusetts Inst. of Tech., Dept. of Aeronautics and Astronautics, USA

**CAPRI: Using a Geometric Foundation for Computational Analysis and Design** ***Final Report***

Haimes, Robert, Massachusetts Inst. of Tech., USA; [2002]; 6p; In English
Contract(s)/Grant(s): NAG3-2523; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

CAPRI (Computational Analysis Programming Interface) is a software development tool intended to make computerized design, simulation and analysis faster and more efficient. The computational steps traditionally taken for most engineering analysis (Computational Fluid Dynamics (CFD), structural analysis, etc.) are: Surface Generation, usually by employing a Computer Aided Design (CAD) system; Grid Generation, preparing the volume for the simulation; Flow Solver, producing the results at the specified operational point; Post-processing Visualization, interactively attempting to understand the results. It should be noted that the structures problem is more tractable than CFD; there are fewer mesh topologies used and the grids are not as fine (this problem space does not have the length scaling issues of fluids). For CFD, these steps have worked well in the past for simple steady-state simulations at the expense of much user interaction. The data was transmitted between phases via files. In most cases, the output from a CAD system could go IGES files. The output from Grid Generators and Solvers do not really have standards though there are a couple of file formats that can be used for a subset of the gridding (i.e. PLOT3D) data formats and the upcoming CGNS). The user would have to patch up the data or translate from one format to another to move to the next step. Sometimes this could take days. Instead of the serial approach to analysis, CAPRI takes a geometry centric approach. CAPRI

is a software building tool-kit that refers to two ideas: (1) A simplified, object-oriented, hierarchical view of a solid part integrating both geometry and topology definitions, and (2) programming access to this part or assembly and any attached data. The connection to the geometry is made through an Application Programming Interface (API) and not a file system.
Derived from text
*Software Development Tools; Computational Fluid Dynamics; Computational Grids; Design Analysis; Grid Generation (Mathematics); Computerized Simulation; Applications Programs (Computers)*

## 62
## COMPUTER SYSTEMS

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

**20020065345** Corps of Engineers, Washington, DC USA
**Electronic Mail**
Brown, William D.; Mar. 21, 1994; 16p; In English
Report No.(s): AD-A403499; ER-25-1-74; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This regulation establishes policy, standards, and guidelines regarding the use of electronic mail as an official medium for transmitting information.
DTIC
*Electronic Mail; Message Processing; Transmission*

**20020065350** Massachusetts Inst. of Tech., Lab. of Electronics, Cambridge, MA USA
**Quantum Logic and Parallel Computing Using Spectral Holeburning Technologies** ***Final Report, 1 Mar. 1998-31 Oct. 2001***
Shahriar, Selim; Ezekiel, Shaoul; Lloyd, Seth; Oct. 2001; 40p; In English
Contract(s)/Grant(s): F49620-98-1-013
Report No.(s): AD-A403587; AFOSR-2305/DS; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The objective of this project was to investigate the use of spectral holeburning technologies for quantum logic and parallel computing. to this end, we have made substantial progress on both experimental and theoretical fronts. In NV-diamond, we have demonstrated the alignment of spins, which can then be used as quantum bits for a quantum computer. We have performed high resolution imaging of color centers in NV-diamond, as a key step towards isolating and detecting individual quantum bits. We have also developed a detailed model for cavity induced coupling of qubits in this system. Furthermore, we have developed a concrete design for producing a photonic band gap based cavity directly in a diamond substrate. Such a cavity will have the requisite combination of high finesse and low loss necessary for photon-mediated coupling of qubits, which is not possible using bulk mirror cavities because of high surface reflection losses from an embedded crystal. We have also developed a novel model for cavity-induced coupling via the atom-cavity-dark-state, a process that is robust against atomic as well cavity decay. Finally, we have identified a mechanism for direct dipole-dipole coupling of the qubits as well. This scheme is particularly well suited for creating in parallel many quantum computers, each containing a small number of coupled qubits. Dubbed Type II Quantum Computing, this architecture is expected to outperform the best classical computers in specialized tasks such as modeling turbulence through the cellular automaton based lattice gas dynamics. In Pr:YSO, we have demonstrated a slowing (45 misec) and high-fidelity storage and recall of light pulses. This scheme is expected to enable the realization of a near-perfect quantum memory for single-photons, storing and recalling it with near 100% fidelity.
DTIC
*Quantum Theory; Applications Programs (Computers); Logic Programming*

**20020065420** Air Force Communications Command, Scott AFB, IL USA
**Air Force Instruction 33-129 Communications and Information Transmission of Information Via the Internet**
Apr. 04, 2001; 53p; In English; Supersedes AFI 33-129, dtd 1 Aug. 1999
Report No.(s): AD-A403646; AFI 33-129; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
This Air Force instruction (AFI) implements Air Force Policy Directive (AFPD) 37-1, Air Force Information Management (will convert to AFPD 33-3); AFPD 35-2, Public Communications Programs; AFPD 33-1, Command, Control, Communications, and Computer (C4) Systems; and AFPD 33-2, Information Protection.
DTIC
*Internets; Information Management; Command and Control; Data Transmission*

**20020065423** Wisconsin Univ., Milwaukee, WI USA

**Critical Analysis of the Use of Redundancy to Achieve Survivability in the Presence of Malicious Attacks** ***Final Report, Apr. 1997-May 1999***

Desmedt, Yvo; Apr. 2002; 9p; In English

Contract(s)/Grant(s): F30602-97-1-0205; DARPA ORDER-F165; AF Proj. F165

Report No.(s): AD-A403635; AFRL-IF-RS-TR-2002-86; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

From the research on communication security one learns that, although redundancy has been utilized to achieve reliability, if the errors are caused maliciously, then the use of redundancy does not necessarily work. The goal is to adapt the lesson from the research on communication security to study when redundancy can and cannot be used to achieve survivability. Although this study was curtailed by the removal of funding, partial results were obtained for generalizing the attack to redundant computations of multiple inputs and creating an algorithm to identify the most critical tasks.

DTIC

*Computer Networks; Errors*

**20020065518** California Univ., Santa Cruz, CA USA

**Protocols for Secure Survivable Active Internetworking** ***Final Report, Jun. 1997-Oct. 1999***

Aceves, J. J.; May 2002; 18p; In English

Contract(s)/Grant(s): F30602-97-1-0291; DARPA Order F320; AF Proj. F320

Report No.(s): AD-A403698; AFRL-IF-RS-TR-2002-98; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report covers work done in three areas: 1) Active destination-oriented QoS support; 2) Active and secure routing and multicasting; 3) Trusted dissemination of active packets.

DTIC

*Computer Information Security; Computer Networks*

**20020065557** Sandia National Labs., Albuquerque, NM USA

**Technology Foundation for Policy Based Networking with an Emphasis on Enterprise Cyber Security**

Keliiaa, C. M.; Mar. 2002; 24p; In English

Report No.(s): DE2002-020514; SAND2002-0514; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Contents include the following: Introduction; The Technology Foundation; Cyber Security Implications; Enabling Technologies; Policy-Based Networking; A Policy Architecture For The Enterprise Network; Policy-Based Network Management; Phased Migration Strategy; Summary; Conclusion; List of Figures; Appendix A; Technical References and Related Information.

NTIS

*Computer Networks; Security; Technology Assessment*

**20020066432** Rainfinity, San Jose, CA USA

**Rocket Science for the Internet**

Spinoff 2000; 2000, pp. 58; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

Rainfinity, a company resulting from the commercialization of Reliable Array of Independent Nodes (RAIN), produces the product, Rainwall. Rainwall runs a cluster of computer workstations, creating a distributed Internet gateway. When Rainwall detects a failure in software or hardware, traffic is shifted to a healthy gateway without interruptions to Internet service. It more evenly distributes workload across servers, providing less down time.

Author

*Technology Utilization; Fault Tolerance; Fault Detection; Internets; Information Flow*

**20020066452** WetStone Technologies, Inc., Cortland, NY USA

**Computer Security Assistance Program for the Twenty-First Century (CSAP21) Advancement and Expert Technology Exchange (CAETE)** ***Final Report, Jun. 1999-Jun 2000***

Hosmer, Chester; Apr. 2002; 40p; In English; Original contains color images

Contract(s)/Grant(s): F30602-99-C-0041; AF Proj. 7920

Report No.(s): AD-A403491; AFRL-IF-RS-TR-2002-75; No Copyright; Avail: CASI; A03, Hardcopy

This contract final technical report documents the CSAP21 Advancement and Expert Technology Exchange (CAETE) project results. This project expanded the capabilities of the Computer Security Assistance Program for the Twenty-First Century

(CSAP21) system of systems architecture by enhancing and expanding the functionality of the Network Monitoring and Assessment (NMA) module of the Interactive Information Protection Decision Support System (IIPDSS) testbed.
DTIC
*Computer Programs; Computer Networks; Information Systems; Computer Information Security*

**20020066453** Naval Postgraduate School, Dept. of Computer Science, Monterey, CA USA
**A Best Effort Traffic Management Solution for Server and Agent-Based Active Network Management (SAAM)**
Wofford, Corey D.; Mar. 2002; 163p; In English; Original contains color images
Report No.(s): AD-A403522; No Copyright; Avail: CASI; A08, Hardcopy

Server and Agent-based Active Network Management (SAAM) is a promising network management solution for the Internet of tomorrow, ”Next Generation Internet (NGI).” SAAM is a new network architecture that incorporates many of the latest features of Internet technologies. The primary purpose of SAAM is managing network quality of service (QoS) to support the resource-intensive next-generation Internet applications. Best effort (BE) traffic will continue to exist in the era of NGI. Thus SAAM must be able to manage such traffic. In this thesis, we propose a solution for management of BE traffic within SAAM. With SAAM, it is possible to make a ”better best effort” in routing BE packets. Currently, routers handle BE traffic based solely on local information or from information obtained by link-state flooding which may not be reliable. In contrast, SAAM centralizes management at a server where better (more optimal) decisions can be made. SAAM’s servers have access to accurate topology and timely traffic-condition information. Additionally, due to their placement on high-end routers or dedicated machines, the servers can better afford computationally intensive routing solutions. It is these characteristics that are exploited by the solution design and implementation of this thesis.
DTIC
*Internets; Packets (Communication); Topology; Networks*

**20020066457** Creare, Inc., Hanover, NH USA
**The Center of Attention**
Spinoff 2000; 2000, pp. 68; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

New Hampshire-based Creare, Inc. used a NASA SBIR contract with Dryden to develop ”middleware” known commercially as DataTurbine. DataTurbine acts as ”glueware” allowing communication between dissimilar computer platforms and analysis, storage and acquisition of shared data. DataTurbine relies on Ring Buffered Network Bus technology, which is a software server providing a buffered network path between suppliers and consumers of information.
Author
*Technology Utilization; Data Integration; Applications Programs (Computers); Data Transfer (Computers)*

**20020066480** NetLander, Inc., Titusville, FL USA
**Geographic Freedom**
Spinoff 2000; 2000, pp. 63; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

Kennedy Space Center’s need to conduct real-time monitoring of Space Shuttle operations led to the development of Netlander Inc.’s JTouch system. The technology behind JTouch allows engineers to view Space Shuttle and ground support data from any desktop computer using a web browser. Companies can make use of JTouch to better monitor locations scattered around the world, increasing decision-making speed and reducing travel costs for site visits.
Author
*Technology Utilization; Real Time Operation; Data Acquisition; World Wide Web; Information Transfer*

**20020066580** Economics and Statistics Administration, Washington, DC USA
**Nation Online: How Americans Are Expanding Their Use of the Internet**
Feb. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): PB2002-107910; No Copyright; Avail: National Technical Information Service (NTIS)

This report provides comprehensive information on Americans’ connectivity to the Internet, broadband services, and computers. Increasing numbers of Americans have integrated these technologies into their daily lives and are using them in a variety of places and for a wide range of activities.
NTIS
*Internet Resources; Information Management*

**20020066606** BAE Systems Portal Solutions, Inc., Rome, NY USA

**Independent Testing and Integration of the Network Management Guard Proxy** ***Final Report, Apr. 1999-Jan. 2002***

Hovak, Adam; Riolo, Joe; May 2002; 57p; In English; Original contains color images

Contract(s)/Grant(s): F30602-99-C-0077; Proj-233G

Report No.(s): AD-A403680; AFRL-IF-RS-TR-2002-106; No Copyright; Avail: CASI; A04, Hardcopy

The document provides an overview of the network management guard/proxy. The network management guard/proxy is a modified firewall that sits between two networks of different classification levels. This modified firewall is used to provide network monitoring and control of multilevel networks. It sits between the high-side network management platform and the low-side network management platform via a virtual private network (VPN). The guard/proxy only allows information to pass between the two network management platforms based upon the integrity policy defined at the guard/proxy startup. This allows the high network management system to be able to monitor both the high-side and low-side networks. Furthermore this document contains information on the configuration of the boundary device, demonstrations that were accomplished, and testing that was completed during this contract.

DTIC

*Computer Networks; Classifications; Network Control*

**20020066784** NASA Ames Research Center, Moffett Field, CA USA

**Graduating to Postdoc: Information-Sharing in Support of Organizational Structures and Needs**

Keller, Richard M., NASA Ames Research Center, USA; Lucas, Paul J., Caelum Research Corp., USA; Compton, Michael M., RECOM Technologies, Inc., USA; Stewart, Helen J., NASA Ames Research Center, USA; Baya, Vinod, Caelum Research Corp., USA; DelAlto, Martha, Caelum Research Corp., USA; September 1999; 15p; In English; Original contains color illustrations

Contract(s)/Grant(s): RTOP 632-30-00

Report No.(s): NASA/TM-1999-208771; A-9901027; NAS 1.15:208771; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The deployment of information-sharing systems in large organizations can significantly impact existing policies and procedures with regard to authority and control over information. Unless information-sharing systems explicitly support organizational structures and needs, these systems will be rejected summarily. The Postdoc system is a deployed Web-based information-sharing system created specifically to address organizational needs. Postdoc contains various organizational support features including a shared, globally navigable document space, as well as specialized access control, distributed administration, and mailing list features built around the key notion of hierarchical group structures. We review successes and difficulties in supporting organizational needs with Postdoc

Author

*Access Control; Data Structures; Information Systems*

## 63
## CYBERNETICS, ARTIFICIAL INTELLIGENCE AND ROBOTICS

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

**20020065312** Naval Academy, Annapolis, MD USA

**Acquisition of 3-D Map Structures for Mobile Robots**

Fong, Edward Hsiang; May 07, 2002; 66p; In English; Original contains color images

Report No.(s): AD-A403360; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

For an autonomous mobile robot to move around intelligently in its surroundings, it must possess a map of the environment which it can use to determine where it is, where it wants to go, and the best way to get there. The ability to successfully navigate in its surroundings allows the robot to perform more complicated tasks with greater autonomy. When a mobile robot is introduced into an unfamiliar environment, it does not have that map available and therefore must generate one itself. Methods currently exist to perform such a task in an environment where the robot moves about a single plane. However, this limitation restricts the robot's movement to a at and smooth surface (typically an indoor setting). This project builds upon current map building techniques to enable a ground-based mobile robot to navigate robustly in an unfamiliar, more three-dimensional (outdoor) environment. A new map structure has been developed to store three-dimensional information in a compressed form. It represents the robot's environment as a two-dimensional surface existing in three-dimensional space. This map structure was implemented on an all-terrain outdoor robot for use in urban environments. The map structure was tested both by comparing generated maps to the

environment on which they were based, and by testing the robots ability to navigate with them. The map structure has been shown to accurately model the robot's environment and enable the robot to navigate in it while requiring few computational resources.
DTIC
*Mobility; Robots; Autonomy*

**20020065377** NASA Ames Research Center, Moffett Field, CA USA
**Intelligent Systems for Aerospace Engineering: An Overview**
Krishnakumar, Kalmanje, NASA Ames Research Center, USA; Mar. 13, 2002; 16p; In English; von Karman Institute Lecture Series on Intelligent Systems for Aeronautics, 13-17 May 2002, Brussels, Belgium; Sponsored by Von Karman Inst. for Fluid Dynamics, Belgium
Contract(s)/Grant(s): RTOP 704-30-62; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Intelligent systems are nature-inspired, mathematically sound, computationally intensive problem solving tools and methodologies that have become extremely important for advancing the current trends in information technology. Artificially intelligent systems currently utilize computers to emulate various faculties of human intelligence and biological metaphors. They use a combination of symbolic and sub-symbolic systems capable of evolving human cognitive skills and intelligence, not just systems capable of doing things humans do not do well. Intelligent systems are ideally suited for tasks such as search and optimization, pattern recognition and matching, planning, uncertainty management, control, and adaptation. In this paper, the intelligent system technologies and their application potential are highlighted via several examples.
Author
*Artificial Intelligence; Aerospace Engineering; Fuzzy Systems; Optimization*

**20020066340** Northwestern High School, Rockhill, SC USA
**First Robotics Competition**
Aldridge, Lori, Northwestern High School, USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 379-406; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

This document is designed to help teams develop successfully during the Competition season. For Inspiration and Recognition of Science and Technology (FIRST) Robotics competition was founded by Dean Kamen, President of DEKA Research and Development Corp.
Derived from text
*Robotics; Technologies; Competition*

**20020066463** Naval Postgraduate School, Monterey, CA USA
**Analysis and Modeling of the Virtual Human Interface for the MARG Body Tracking System Using Quaternions**
Sinav, Alper; Mar. 2002; 87p; In English; Original contains color images
Report No.(s): AD-A403544; No Copyright; Avail: CASI; A05, Hardcopy

Mathematicians have used quaternions for about a hundred years. Today they are an important part of computer graphics and simulation systems. This thesis takes an analytical approach to quaternions by using them in the construction of a virtual human for sourceless Magnetic Accelerometer Rate Sensor (MARG) body tracking system. Virtual citizens will be a reflection of our personalities in cyberspace. Prophecies say they may take control in the virtual world and govern themselves too. One of the objectives of this thesis is to design a seamless and realistic humanoid from laser scan data clouds. This humanoid will be compatible with notion capture systems and networked virtual environments. Second objective of this thesis is to search for the answers related to the optimal real-time representation of an articulated virtual human, maintaining a high level of visual fidelity within networked cyberspace. While visual detail and fidelity have been and will continue to be a major ongoing interest within the computer graphics community, the idea of sourceless body tracking is still in its early stages. MARG body tracking is one of the successful approaches to body tracking systems. This thesis proposes a networked quaternion based real-time virtual human interface for the MARG body tracking system.
DTIC
*Computerized Simulation; Computer Graphics; Virtual Reality; Accelerometers*

**20020066493** Blue Martini Software, Inc., San Mateo, CA USA
**Giving E-Commerce a Boost**
Spinoff 2000; 2000, pp. 69; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

A former Ames employee, Monte Zweben, founded a new company, Blue Martini Software, that provides software to companies seeking to personalize their products to individual customers. This customer targeting approach is accomplished through the use of artificial intelligence concepts Zweben worked on while at Ames. The Ames AI research has found applications in clickstream mining and purchasing behavior data collection.
Author
*Technology Utilization; Electronic Commerce; Data Acquisition; Artificial Intelligence; Applications Programs (Computers)*

**20020066740** Carnegie-Mellon Univ., Robotics Inst., Pittsburgh, PA USA
**Pittsburgh Public School District / Carnegie Mellon University Robotics Team Participation in the US First Competition *Final Report***
Stroupe, Ashley, Carnegie-Mellon Univ., USA; [2002]; 1p; In English
Contract(s)/Grant(s): JSC-11-00-9679; NAG9-1276; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
FIRST, For Inspiration and Recognition of Science and Technology, is an international program designed to encourage junior and senior high school students to participate in science and technology related activities. FIRST attempts to increase enthusiasm for technology by providing a competitive environment in which to demonstrate robotics technology designed for a particular set of tasks. Carnegie Mellon University provided student members of the project the opportunity to complete the design, construction, testing, and operation of a robot. Electrical, mechanical, and programming skills were stressed, with both adult and senior students acting as mentors for more junior members. Teamwork and integration was also stressed in order to provide students with a realistic feel for project-based work. Finally, an emphasis was placed on recruiting students with greater difficulty in entering technological fields: girls and ethnic minorities and students leaning toward humanities (especially art). Carnegie Mellon built a relationship with Taylor Allderdice High School that lasted four years. For four years, the success of the project increased each year. Each term, the students successfully designed and built a working robot that could fully participate in the competition. The enthusiasm of the students has been the cornerstone of the recruit of new students, keeping the project growing and vital. Carnegie Mellon's participation with Allderdice has been an overall great success.
Derived from text
*Education; Students; Robotics; Universities*

**20020066765** NASA Ames Research Center, Moffett Field, CA USA
**Challenging Aerospace Problems for Intelligent Systems**
Krishnakumar, Kalmanje, NASA Ames Research Center, USA; Kanashige, John, NASA Ames Research Center, USA; Satyadas, A., International Business Machines Corp., USA; Mar. 13, 2002; 15p; In English; Von Karman Institute Lecture Series on Intelligent Systems for Aeronautics, 13-17 May 2002, Brussels, Belgium; Sponsored by Von Karman Inst. for Fluid Dynamics, Belgium
Contract(s)/Grant(s): RTOP 704-30-62; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
In this paper we highlight four problem domains that are well suited and challenging for intelligent system technologies. The problems are defined and an outline of a probable approach is presented. No attempt is made to define the problems as test cases. In other words, no data or set of equations that a user can code and get results are provided. The main idea behind this paper is to motivate intelligent system researchers to examine problems that will elevate intelligent system technologies and applications to a higher level.
Author
*Artificial Intelligence; Genetic Algorithms; Systems Engineering; Aerospace Systems; Computer Aided Design*

**20020067642** NASA Goddard Space Flight Center, Greenbelt, MD USA
**The Estimation Theory Framework of Data Assimilation**
Cohn, S., NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; NATO Advanced Study Institute, 19 May - 1 Jun. 2002, Maratea, Italy; Sponsored by NATO Advanced Study Inst., Belgium; No Copyright; Avail: Issuing Activity; Abstract Only
Lecture 1. The Estimation Theory Framework of Data Assimilation: 1. The basic framework: dynamical and observation models; 2. Assumptions and approximations; 3. The filtering, smoothing, and prediction problems; 4. Discrete Kalman filter and smoother algorithms; and 5. Example: A retrospective data assimilation system
Author
*Assimilation; Data Systems; Estimating*

## 64
## NUMERICAL ANALYSIS

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

**20020065285** Army Research Lab., Survivability Lethality Analysis Directorate, Aberdeen Proving Ground, MD USA
**BRL-CAD Tutorial Series, Volume 1, Overview and Installation**
Butler, Lee A.; Edwards, Eric W.; Feb. 2002; 38p; In English; Original contains color images; --Original contains color plates: All DTIC reproductions will be in black and white.
Report No.(s): AD-A403602; ARL-SR-113; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Since 1979, the U.S. Army Research Laboratory has been developing and distributing the BRL-CAD constructive solid geometry (CSG) modeling package for a wide range of military and industrial applications. The package includes a large collection of tools and utilities including an interactive geometry editor, raytracing and generic framebuffer libraries, a network-distributed image-processing and signal-processing capability, and an embedded scripting language. As part of this effort, a multivolume tutorial series is being developed to assist users in the many features of the BRL-CAD package. The 'Overview and Installation guide', which is the first volume in the series, addresses the background, purpose, and strengths of the package; the libraries and utilities included within it; platform-specific installation instructions; and information about bugs and updates. Other volumes focus on advanced features, individual utilities, and programming.
DTIC
*Computer Aided Design; Applications Programs (Computers)*

**20020065306** Defence Research Establishment Ottawa, Ottawa, Ontario Canada
**A Novel Approach for the Wigner Distribution Formulation of the Optimum Detection Problem for a Discrete-Time Chirp Signal**
Thayaparan, Thayananthan; Yasotharan, Ambighairajah; Nov. 2001; 66p; In English
Report No.(s): AD-A403432; DREO-TM-2001-141; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The Wigner distribution is a signal transformation which has its origin in quantum mechanics. It possesses some important properties which make it very attractive for time-frequency signal analysis. The Wigner distribution was originally defined for continuous-time signals. A discrete-time version of it was proposed recently. Unfortunately, this discrete-time Wigner distribution suffers from aliasing effects, which prevent several of the properties of the continuous-time Wigner distribution from carrying over straightforwardly. In this report, a discrete-time Wigner distribution which does not suffer from aliasing is introduced. It is essentially an augmentation of the previous version, incorporating new information about the signal not contained in the previous version. A variety of methods have been proposed for the detection of a signal, with unknown signal parameters, in a noisy environment. In this report, the noise statistics are incorporated to reveal that certain processing of the Wigner distribution signal representation can lead to an optimal, and often easy to compute, detection scheme. For the special case of discrete-time chirp signals in complex white Gaussian noise, it is shown that the optimal detector is equivalent to integrating the Wigner distribution along the line of instantaneous frequency. If the position and sweep rate of the linear chirp are unknown, then a Generalized Likelihood Ratio Test (GLRT) leads one to integrate the Wigner distribution along all possible lines in the time-frequency plane and choose the largest integrated value for comparison to a threshold. Simulation examples of the Wigner distribution scheme are given to demonstrate the utility concerning the detection of the proposed method.
DTIC
*Chirp Signals; Discrete Functions; Quantum Mechanics; Signal Processing*

**20020065308** Corps of Engineers, Washington, DC USA
**Engineering and Design: Geotechnical Analysis by the Finite Element Method**
Kamien, Douglas J.; Jul. 31, 1995; 43p; In English
Report No.(s): AD-A403367; ETL-1110-2-544; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This engineer technical letter provides guidance on the use of the finite element method in the analysis of problems in geotechnical engineering. This ETL is intended for engineers who are unfamiliar with the method, but who are interested in understanding its potential use in geotechnical engineering.
DTIC
*Geotechnical Engineering; Finite Element Method*

**20020065317** Maxwell Technologies, Inc., Systems Div., San Diego, CA USA

**Spacecraft Potential Control**

Mandell, M. J.; Davis, V. A.; Gardner, B. M.; Hilton, J. M.; Katz, I.; Feb. 2001; 46p; In English

Contract(s)/Grant(s): F19628-98-C-0074; AF Proj. 2822

Report No.(s): AD-A403333; MSC-DTR-01-16660; AFRL-VS-TR-2001-1619; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of this contract is to develop improved numeric algorithms for the computation of spacecraft charging on earth orbiting spacecraft. This work is part of the Nascap2k program. which is a joint program with the Space Environment Effects (SEE) program at NASA/MSFC. The end result of the program will be a set of user friendly computer codes that compute spacecraft charging in all environments. This interim report describes the development of a computer code that computes spacecraft charging using the Boundary Element Method (BEM) and the development of the Object Toolkit which is used to define spacecraft geometry and materials for Nascap2k. The algorithms contained in the BEM charging are described here. Nascap2k was tested and expanded by doing spacecraft charging calculations in Support of the STEREO mission. A description of these calculations is included. Finally, this report describes a prototype Rapid Alert Charging Tool that uses geosynchronous environmental information to predict spacecraft charging.

DTIC

*Spacecraft Charging; Boundary Element Method; Coding*

**20020065353** Naval Postgraduate School, Monterey, CA USA

**A DCT-Based Watermarking Algorithm Robust to Cropping and Compression**

Retsas, Ioannis; Mar. 2002; 137p; In English; Original contains color images

Report No.(s): AD-A403589; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Digital watermarking is a highly evolving field, which involves the embedding of a certain kind of information under a digital object (image, video, audio) for the purpose of copyright protection. Both the image and the watermark are most frequently translated into a transform domain where the embedding takes place. The selection of both the transform domain and the particular algorithm that is used for the embedding of the watermark, depend heavily on the application. One of the most widely used transform domains for watermarking of still digital images is the Discrete Cosine Transform domain. The reason is that the Discrete Cosine Transform is a part of the JPEG standard, which in turn is widely used for storage of digital images. In our research we propose a unique method for DCT-based image watermarking. In an effort to achieve robustness to cropping and JPEG compression we have developed an algorithm for rating the 8 x 8 blocks of the image DCT coefficients taking into account their embedding capacity and their spatial location within the image. Our experiments show that the proposed scheme offers adequate transparency, and works exceptionally well against cropping while at the same time maintains sufficient robustness to JPEG compression.

DTIC

*Algorithms; Images; Digital Computers*

**20020065370** TRW Space and Electronics Group, Redondo Beach, CA USA

**Electromagnetic Scattering from Multiple Scale Geometries** ***Final Report, 1 Mar. 1999-28 Feb. 2002***

Caponi, Maria Z.; Sei, Alain; May 31, 2002; 140p; In English

Contract(s)/Grant(s): F49620-99-C-0014

Report No.(s): AD-A403279; Rept-1A570-0001-UT-01; AFRL-SR-AR-TR-02-0797; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This final technical report describes the development, implementation, numerical validation and potential exploitation of an accurate and efficient scattering solvers to compute the horizontal (TE mode) and vertical (TM mode) polarization returns from multi-scale surfaces. This modeling effort was motivated by a large number of remote sensing applications that require the characterization by means of radar scattering measurements of the scattering surface configuration or variations in the surface patterns for detection or environmental purposes. The nature of the relevant scattering surfaces and the measured scattered fields drives the need for an extremely accurate scattering solver able to deal with multi-scale surfaces in an efficient manner. This objective was achieved by using a combination of perturbation and asymptotic expansions and an innovative and careful implementation of these expansions for full double precision accuracy. The Fourier series representations used in this problem allowed for very efficient computations due the relatively small order of these series in typical cases. HH and VV polarization have been implemented and allow the rigorous investigation of critical remote sensing problems.

DTIC

*Ocean Surface; Electromagnetic Scattering; Exploitation; Fourier Series*

**20020065511** Naval Postgraduate School, Monterey, CA USA

**Minimization of SOPs for Bi-Decomposable Functions and Non-Orthodox/ Orthodox Functions**

Ulker, Birol; Mar. 2002; 146p; In English

Report No.(s): AD-A403706; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Minimization is one of the most important issues in logical design. When we decide to develop a circuit to perform a certain task, one of the most important steps is to create this circuit with the minimum number of logical elements, since this reduces the cost, area and latency issues. However, minimization may require too much time, affecting the circuit's cost. There are many minimization tools. Each of them uses a different approach to solve the minimization problem. Considering the speed of the minimization process, those that split the functions into components and minimize each component separately yield the highest efficiency.

DTIC

*Algorithms; Functions (Mathematics)*

**20020066191** Swedish Defence Research Establishment, Aeronautics Div., Stockholm, Sweden

**Finite Volume Methods, Unstructured Meshes and Strict Stability**

Adamsson, C.; Forsberg, K.; Nordstroem, J.; May 2001; 46p; In English

Report No.(s): PB2002-105010; FOI-R-0121-SE; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The unstructured node centered finite volume method is analyzed and it is shown that it can be interpreted in the framework of summation by parts operators. It is also shown that introducing boundary conditions weakly produces strictly stable formulations.

NTIS

*Finite Volume Method; Unstructured Grids (Mathematics)*

**20020066703** NASA Ames Research Center, Moffett Field, CA USA

**Numerical Simulations of an Unsteady Rocket Launch from the AH-64D Apache Longbow Helicopter**

Okamoto, Kevin, MCAT Inst., USA; Dugue, Earl P. N., MCAT Inst., USA; Ahmad, Jasim, MCAT Inst., USA; [1998]; 1p; In English; 4th Symposium on Overset Composite Grid and Solution Technology, 23-25 Sep. 1998, Aberdeen Proving Ground, MD, USA

Contract(s)/Grant(s): NAS2-14109; No Copyright; Avail: Issuing Activity; Abstract Only

Rocket and missile firings from attack helicopters can cause main engine compressor stall. Studies of this phenomenon suggest that the main engine ingests either the plume from the rockets or the rocket blast waves. This creates surges at the inlet face, causing a loss of power in the main engine. The objective of this project is to set-up a computational fluid dynamics (CFD) simulation of the AH-64D Apache Longbow helicopter during a rocket launch, in order to qualitatively study the fluid dynamics of the problem. This project presents a progression of three unsteady Navier-Stokes solutions. The first unsteady solution involves only a rocket launch from its launch canister. The second solution is a launch from a canister mounted on the Apache's wing-pylon assembly. The last solution includes the Apache main engine and fuselage. The computations use a series of structured, overset grid systems, which allow for a rocket moving in a prescribed path. The method implements a Roe upwind scheme with LU-SGS (lower-upper factored symmetric Gauss-Seidel). A rotor pressure disk model approximates the helicopter rotor, while the rocket engine exit properties are applied as a prescribed boundary condition. Although the project is only at the half-way point, the first and second CFD simulations suggest the possibility of pressure wave interference. Sudden surges in pressure occur from two sources: at rocket start-up, and as the rocket leaves the canister. Wave patterns set-up by these sources appear to propagate to the location of the engine inlet. However the simplified geometry simulation with the main engine needs to be performed before coming to a conclusion.

Author

*AH-64 Helicopter; Rocket Firing; Aerodynamic Stalling; Turbocompressors; Navier-Stokes Equation; Computational Fluid Dynamics; Structured Grids (Mathematics); Computerized Simulation; Rocket Launchers; Engine Failure*

## 65
## STATISTICS AND PROBABILITY

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

**20020065276** Technical Research Centre of Finland, Electronics, Espoo, Finland
**Discrete Hidden Markov Modes with Application to Isolated User-Dependent Hand Gesture Recognition**
Maetylae, V. M.; 2001; 112p; In English
Report No.(s): PB2002-103476; VTT-PUB/449; Copyright; Avail: National Technical Information Service (NTIS), Microfiche
The development of computers and the theory of doubly stochastic processes, have led to a wide variety of applications of the hidden Markov models (HMMs). Due to their computational efficiency, discrete HMMs are often favoured. HMMs offer a flexible way of presenting events with temporal and dynamical variations. Both of these matters are present in hand gestures, which are of increasing interest in the research of human-computer interaction (HCI) technologies. The exploitation of human-to-human communication modalities has become actual in HCI applications. It is even expected, that the existing HCI techniques become a bottleneck in the effective utilization of the available information flow. In this work it is given mathematically uniform presentation of the theory of discrete hidden Markov models. Especially, three basic problems, scoring, decoding and estimation, are considered. to solve these problems it is presented forward and backward algorithms, Viterbi algorithm, and Baum-Welch algorithms, respectively.
NTIS
*Human-Computer Interface; Markov Chains; Information Flow; Computers*

**20020065342** Defence Research Establishment Ottawa, Ottawa, Ontario Canada
**A Novel Method for Statistical Comparison of Geophysical Data by Multiple Instruments which have Differing Accuracies**
Thayaparan, T.; Hocking, W. K.; Franke, S. J.; Nov. 2001; 32p; In English
Report No.(s): AD-A403436; DREO-TM-2001-147; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
A novel correlative technique is introduced for comparison of measurements of similar quantities made using different techniques. This process involves a generalized least-squares fitting method which can be used to estimate the slope of the best-fitting straight line that results when two separate data sets that are expected to be linearly correlated are compared via scatter-plots. The different data types may be subject to different uncertainties in their measurements. The technique determines and graphs the relationship between the errors in each method and the slope of the line of best fit, assuming Gaussian statistics. We hope that this new technique will find application in a wide range of situations, e.g., ranging from radar and satellite measurements to any physical measurements. The technique can also be used to calibrate multi-sensor, radar and satellite systems.
DTIC
*Geophysics; Multisensor Applications; Correlation; Statistical Analysis*

**20020065371** Corps of Engineers, Washington, DC USA
**Engineering and Design: Introduction to Probability and Reliability Methods for Use in Geotechnical Engineering**
Kamien, Douglas J.; Sep. 30, 1997; 15p; In English
Report No.(s): AD-A403281; ETL-1110-2-547; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This letter provides an introduction to the use of probabilistic methods in geotechnical engineering.
DTIC
*Geotechnical Engineering; Probability Theory; Reliability*

## 66
## SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

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

**20020065368** National Science Foundation, Arlington, VA USA
**Multinational Coordinated 'Arabidopsis thaliana' Functional Genomics Project. Beyond the Whole Genome Sequence: The Multinational Arabidopsis Steering Committee**
Jun. 2002; 40p; In English
Report No.(s): PB2002-107868; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A long-range plan for the Multinational Coordinated Arabidopsis thaliana Functional Genomics Project has been developed by the international community of scientists engaged in the study of basic plant biology using Arabidopsis as a model system. The project was conceived and developed in response to the completion of the Arabidopsis genome sequence by the Arabidopsis Genome Initiative in December of 2000. For the first time, scientists have access to the sequence of the 25,500 genes required for the functioning of a flowering plant. This information brings with it an opportunity: the chance to exploit this newfound knowledge to bring about the complete understanding of plant biology. The international community of plant scientists enters into the new era of functional genomics research with the realization that in order to meet the needs of an expanding world population and of protecting the environment for future generations, we must find ways to improve the plants that we rely on for our existence; that before we can efficiently make improvements to economically important plant species, we must further our knowledge of plant biology; and that the best way to rapidly and efficiently gain this knowledge is through the use of the experimental model system Arabidopsis thaliana.
NTIS
*Plants (Botany); Research and Development; Genome*

**20020066448** USA Transportation Command, Scott AFB, IL USA
**Transportation M and S for the DTS Providing End-to-End Force Projection Analysis**
Seaman, Keith R.; Jun. 03, 1999; 30p; In English; Original contains color images
Report No.(s): AD-A403308; No Copyright; Avail: CASI; A03, Hardcopy
No abstract.
Author
*Mathematical Models; Transportation*

**20020066582** General Accounting Office, Washington, DC USA
**Missile Defense: Knowledge-Based Decision Making Needed to Reduce Risks in Developing Airborne Laser**
Jul. 2002; 30p; In English
Report No.(s): PB2002-108122; GAO-02-631; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
In January 2002, the Secretary of Defense announced broad changes to the department's strategy for developing and acquiring missile defense systems. Specifically, the Defense Secretary designated the Ballistic Missile Defense Organization as the Missile Defense Agency and granted the agency expanded responsibility and authority. The Secretary directed the agency to develop an integrated system with various elements that have the capability to attack enemy missiles in all phases of their flight, transition responsibility for the production and fielding of systems to the individual services, and encourage incremental improvements by inserting new technologies through a series of block upgrades. The Airborne Laser is one of many systems affected by the new strategy. You asked us to determine (1) why the systems development is costing more and taking longer than the Air Force originally estimated and (2) whether the Missile Defense Agency's new strategy for developing the Airborne Laser incorporates the practices that characterize successful programs.
NTIS
*Laser Weapons; Missile Defense; Congressional Reports*

**20020066608** Army Model and Simulation Office, Washington, DC USA
**SMART: Concept Exploration Phase Challenges and Opportunities**
Collier, K. S.; Jun. 1999; 15p; In English; Original contains color images
Report No.(s): AD-A403733; No Copyright; Avail: CASI; A03, Hardcopy
Current AMSO Priorities 1. Devise a cost effective evolution plan for each M&S domain- develop and maintain a smaller, more robust set of M&S (JWARS, JSIMS/WARSIM, JMASS, AWARS, Combat XXI, CCTT, OneSAF) 2. Evolve M&S domains towards the integrated use of Simulations and Models across the areas of Acquisition, Requirements, and Training (SMART) 3. Promote commonality, re-use, credibility and interoperability through M&S Standards 4. Tackle immediate challenges such as C4I to M&S interfaces, synthetic terrain, threat representations, and chem/bio M&S.
DTIC
*Simulation; Acquisition; Models; Education*

## 67
## THEORETICAL MATHEMATICS

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

**20020066731** Defence Science and Technology Organisation, Surveillance Systems Div., Australia
**Inverting the Circular Radon Transform**
Redding, Nicholas J., Defence Science and Technology Organisation, Australia; Newsam, Garry N., Defence Science and Technology Organisation, Australia; August 2001; 60p; In English
Report No.(s): DSTO-RR-0211; DODA-AR-011-855; Copyright; Avail: Issuing Activity

In this report we show how image formation or reconstruction in synthetic aperture radar (SAR) can be viewed as the inversion of the circular Radon transform. The advantage of viewing image formation in this way is that it could be used in situations where more standard methods could fail such as high squint and ultra-wideband SAR. We examine previous work in the literature on circular Radon transforms and their inversion. Next, we present some novel techniques and analytic expressions for the transform of some key functions. We briefly consider motion compensation. Finally, we propose a number of possible methods that could be pursued to make new practical image formation algorithms.
Author
*Synthetic Aperture Radar; Transformations (Mathematics); Radar Imagery; Image Reconstruction; Inversions*

**20020066776** NASA Ames Research Center, Moffett Field, CA USA
**High-Order Central WENO Schemes for Multi-Dimensional Hamilton-Jacobi Equations**
Bryson, Steve, NASA Ames Research Center, USA; Levy, Doron, Stanford Univ., USA; [2002]; 38p; In English; SIAM Journal of Numerical Analysis, 1 Jan. 2001, USA; Sponsored by Society for Industrial and Applied Mathematics, USA
Contract(s)/Grant(s): RTOP 704-40-42; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present new third- and fifth-order Godunov-type central schemes for approximating solutions of the Hamilton-Jacobi (HJ) equation in an arbitrary number of space dimensions. These are the first central schemes for approximating solutions of the HJ equations with an order of accuracy that is greater than two. In two space dimensions we present two versions for the third-order scheme: one scheme that is based on a genuinely two-dimensional Central WENO reconstruction, and another scheme that is based on a simpler dimension-by-dimension reconstruction. The simpler dimension-by-dimension variant is then extended to a multi-dimensional fifth-order scheme. Our numerical examples in one, two and three space dimensions verify the expected order of accuracy of the schemes.
Author
*Space Exploration; Size (Dimensions)*

## 70
## PHYSICS (GENERAL)

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

**20020065546** Brookhaven National Lab., Upton, NY USA
**Colour Glass Condensate: An Introduction**
Iancu, E.; Leonidov, A.; McLerran, L.; Feb. 2002; 78p; In English
Report No.(s): DE2002-793050; BNL-69047; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In these lectures, the authors develop the theory of the Colour Glass Condensate. This is the matter made of gluons in the high density environment characteristic of deep inelastic scattering or hadron-hadron collisions at very high energy. The lectures are self contained and comprehensive. They start with a phenomenological introduction, develop the theory of classical gluon fields appropriate for the Colour Glass, and end with a derivation and discussion of the renormalization group equations which determine this effective theory.
NTIS
*Color; Condensates; Glass; Phenomenology; Particle Theory*

**20020065554** Sandia National Labs., Albuquerque, NM USA

**Evaluation of the Material Point Method**

Chen, Z.; Brannon, R.; Feb. 2002; In English

Report No.(s): DE2002-020482; SAND2002-0482; No Copyright; Avail: National Technical Information Service (NTIS)

The theory and algorithm for the Material Point Method (MPM) are documented, with a detailed discussion on the treatments of boundary conditions and shock wave problems. A step-by-step solution scheme is written based on direct inspection of the two-dimensional MPM code currently used at the University of Missouri-Columbia (which is, in turn, a legacy of the University of New Mexico code). to test the completeness of the solution scheme and to demonstrate certain features of the MPM, a one-dimensional MPM code is programmed to solve one-dimensional wave and impact problems, with both linear elasticity and elastoplasticity models. The advantages and disadvantages of the MPM are investigated as compared with competing mesh-free methods. Based on the current work, future research directions are discussed to better simulate complex physical problems such as impact/contact, localization, crack propagation, penetration, perforation, fragmentation, and interactions among different material phases. In particular, the potential use of a boundary layer to enforce the traction boundary conditions is discussed within the framework of the MPM.

NTIS

*Boundary Conditions; Evaluation; Algorithms; Shock Waves; Elastic Properties; Crack Propagation*

**20020066133** Brookhaven National Lab., Upton, NY USA

**Magnetic Design of a High Gradient Quadrupole for the LHC Low-Beta Insertions**

Sabbi, G.; Gourlay, S. A.; Kerby, J.; Lamm, M. J.; Limon, P. J.; 2002; 8p; In English

Report No.(s): DE2002-794093; BNL-69121; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Fermilab, Lawrence Berkeley National Laboratory and Brookhaven National Laboratory have formed a consortium to provide components for the Large Hadron Collider (LHC) to be built at CERN. The U.S. contribution includes half of the high gradient quadrupoles (HGQ) for the inner focusing triplets. In this paper a description of the HGQ magnetic design is given, including short sample limit for field gradient, sources and expected values of systematic and random field errors, and possible strategies for field quality correction.

NTIS

*Quadrupoles; Magnets; Accelerators; Hadrons; Gradients*

**20020066134** Brookhaven National Lab., Upton, NY USA

**Common Coil Design for High Field 2-in-1 Accelerator Magnets**

Gupta, R.; 1998; 8p; In English

Report No.(s): DE2002-794091; BNL-69119; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A common coil design concept for 2-in-1 superconducting accelerator magnets is presented, It practically eliminates the major problems in the ends of high field magnets built with either high temperature superconductors (HTS) or conventional superconductors. Racetrack coils, consisting of rectangular blocks built with either superconducting tapes or cables, are common to both apertures with each aperture containing one half of each coil. The ends are easy to wind with the conductors experiencing little strain. The overall magnet design, construction and tooling are also expected to be simpler than in the conventional cosine theta magnets. The concept is also suitable for superferric and combined function magnet designs. A modular design for an HTS based R&D magnet is also presented.

NTIS

*Magnets; Superconducting Magnets; Coils; Accelerators; High Temperature Superconductors*

**20020066166** Brookhaven National Lab., Upton, NY USA

**Helical Magnet Design for RHIC**

Willen, E.; Gupta, R.; Jain, A.; Kelly, E.; Morgan, G.; 1997; 8p; In English

Report No.(s): DE2002-794090; BNL-69117; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Helical dipole magnets are required in a project for the Relativistic Heavy Ion Collider (RHIC) to control and preserve the beam polarization in order to allow the collision of polarized proton beams. Specifications are for low current superconducting magnets with a 100 mm coil aperture and a 4 Tesla field in which the field rotates 360 degrees over a distance of 2.4 meters. A magnet meeting the requirements has been developed that uses a small diameter cable wound into helical grooves machined into a thick-walled aluminum cylinder.

NTIS

*Superconducting Magnets; Proton Beams; Magnetic Dipoles; Ions; Apertures; Magnets*

**20020066250** Brookhaven National Lab., Upton, NY USA

**Magnets for a Muon Storage Ring**

Parker, B.; Anerella, M.; Escallier, J.; Ghosh, A.; Gupta, R.; 2002; 8p; In English

Report No.(s): DE2002-794022; BNL-68662; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

We present a new racetrack coil magnet design, with an open midplane gap, that keeps decay particles in a neutrino factory muon storage ring from directly hitting superconducting coils. The structure is very compact because coil ends overlap middle sections top and bottom for skew focusing optics. A large racetrack coil bend radius allows react and wind magnet technology to be used for brittle Nb(sub3)Sn superconductors. We describe two versions: Design-A, a magnet presently under construction and Design-B, a further iterated concept that achieves the higher magnetic field quality specified in the neutrino factory feasibility Study-II report. For Design-B reverse polarity and identical end design of consecutive long and short coils offers theoretically perfect magnet end field error cancellation.

NTIS

*Magnets; Muons; Magnetic Fields; Neutrinos; Cryostats; Rings; Polarity*

**20020066475** Argonne National Lab., IL USA

**Rotational Hysteresis of Exchange-Spring Magnets**

Jiang, J. S.; Shull, R. D.; Bader, S. D.; Kaper, H.; Shapiro, A. J.; 2002; 24p; In English

Report No.(s): DE2002-42435; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

We highlight our experimental studies and micromagnetic simulations of the rotational hysteresis in exchange-spring magnets. Magneto-optical imaging and torque magnetometry measurements for SmCo/Fe exchange-spring films with uniaxial in-plane anisotropy show that the magnetization rotation created in the magnetically soft Fe layer by a rotating magnetic field is hysteretic. The rotational hysteresis is due to the reversal of the chirality of the spin spiral structure. Micromagnetic simulations reveal two reversal modes of the chirality, one at low fields due to an in-plane untwisting of the spiral, and the other, at high fields, due to an out-of-plane fanning of the spiral.

NTIS

*Magnets; Magneto-Optics*

**20020066549** Brookhaven National Lab., Upton, NY USA

**Executive Summary of the Snowmass 2001 Working Group (P1) 'Electroweak Symmetry Breaking'**

Carena, M.; Gerdes, D. W.; Haber, H. E.; Turcot, A. S.; Zerwas, P. M.; Feb. 2002; 30p; In English

Report No.(s): DE2002-793482; BNL-69066; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In this summary report of the 2001 Snowmass Electroweak Symmetry Breaking Working c;roup, the main candidates for theories of electroweak symmetry breaking are surveyed, and the criteria for distinguishing among the different approaches are discussed. The potential for observing electroweak symmetry breaking phenomena at the upgraded Tevatron and the LHC is described. We emphasize the importance of a high-luminosity e(t)e(-) linear collider for precision measurements to clarify the underlying electroweak symmetry breaking dynamics. Finally, wc note the possible roles of the u(+)u(-) collider and VLHC for further elucidating the physics of electroweak symmetry breaking.

NTIS

*Broken Symmetry; Particle Accelerators; Muons; Elementary Particle Interactions*

**20020066550** Brookhaven National Lab., Upton, NY USA

**Kaon Physics at BNL**

Kettell, S. H.; 2002; 10p; In English

Report No.(s): DE2002-793393; BNL-69052; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The AGS has had a broad and rich program in kaon physics. With the recent successful commissioning of the Relativistic Heavy Ion Collider (RHIC), the primary role of the AGS has shifted to become an injector of heavy ions for RHIC. Nevertheless, the AGS remains the highest intensity proton synchrotrons in the world and is designed to be available for 20 hours/day when not filling RHIC, and as such retains an important role in the S high energy physics (HEP) program. DOE and BNL have approved and agreed to fund one new HEP experiment to run at the AGS between RHIC fills: the E949 experiment which seeks to make a precise measurement of the branching ratio.

NTIS

*Kaons; Atomic Physics; Injectors; Heavy Ions*

**20020066734** Argonne National Lab., IL USA

**Study of the Radiation Damage of Nd-Fe-B Permanent Magnets**

Job, P. K.; Alderman, J. M.; Martin, R. C.; Simmons, C. M.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-42037; No Copyright; Avail: National Technical Information Service (NTIS)

Nd-Fe-B permanent magnets are highly desirable for use in the insertion devices of synchrotron radiation sources due to their high remanence, or residual magnetic induction, and intrinsic coercivity. However, the radiation environment within high-energy electron storage rings necessitates the determination of the degree of radiation sensitivity as well as the mechanisms of radiation-induced demagnetization.

NTIS

*Permanent Magnets; Radiation Damage; Magnetic Induction; Demagnetization; Remanence*

**20020066769** NASA Goddard Space Flight Center, Greenbelt, MD USA

**Optimal Fitting of Non-linear Detector Pulses with Nonstationary Noise**

Fixsen, D. J., Science Systems and Applications, Inc., USA; Moseley, S. H., NASA Goddard Space Flight Center, USA; Cabera, B., Stanford Univ., USA; Figueroa-Felicianco, E., NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; Transition Edge Sensor Physics Multi-Project Workshop, Unknown; No Copyright; Avail: Issuing Activity; Abstract Only

Optimal extraction of pulses of constant known shape from a time series with stationary noise is well understood and widely used in detection applications. Applications where high resolution is required over a wide range of input signal amplitudes use much of the dynamic range of the sensor. The noise will in general vary over this signal range, and the response may be a nonlinear function of the energy input. We present an optimal least squares procedure for inferring input energy in such a detector with nonstationary noise and nonlinear energy response.

Author

*Noise (Sound); Dynamic Range; Nonlinearity; Optimization*

## 71
## ACOUSTICS

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

**20020065300** Institute TNO of Applied Physics, Delft, Netherlands

**Implementation of the Acoustic Analysis of Box-Like Machinery Foundation Structures in BATSOFT, Part 2** ***Final Report***

Liang, J., Loughborough Univ. of Technology, UK; Petersson, B. A. T., Institut fuer Technische Akustik, Germany; deJong, C. A. F., Institute TNO of Applied Physics, Netherlands; December 2001; 174p; In English

Contract(s)/Grant(s): A00/KM/137; TNO Proj. 008.02706

Report No.(s): TD-0195; HAG-RPT-010171; Copyright; Avail: Issuing Activity

The modules for box-like foundation structures in the BATSOFT calculation software for the structural acoustic analysis of machinery foundation structures have been extended with models for the mobilities associated with in-plane excitation of the top plate and with distributed excitation via larger contact areas. The calculation results have been validated against results of measurements, obtained in a previous study. The remaining discrepancies can most likely be solved by implementation of existing expressions for local deformation in the software. Distribution of the excitation over a larger area generally leads to al lower input power at higher frequencies. The effectiveness of the vibrational power transmission through the foundation to the ship structure appears to be governed by the matching of the mobilities rather than by the loss factor of the foundation structure.

Author

*Acoustic Measurement; Software Engineering; Elastic Bodies; Machinery; Structural Analysis*

**20020065301** Institute TNO of Applied Physics, Delft, Netherlands

**Preparatory Study of Acoustics of Electrical Machines Intended for Marine Propulsion** ***Final Report***

Ing, B., Institute TNO of Applied Physics, Netherlands; deJong, E. C. W., Institute TNO of Applied Physics, Netherlands; Hoeijmakers, M. J., Institute TNO of Applied Physics, Netherlands; Mar. 19, 2002; 71p; In English

Contract(s)/Grant(s): A00/KM/143; TNO Proj. 008.02707/01.01

Report No.(s): TD-0197; DGT-RPT-020040; Copyright; Avail: Issuing Activity

This report illustrates the basic principles of operation of electrical machines (induction and synchronous) intended for marine propulsion. Possible noise sources are identified and listed. The report describes the sources of harmonic noise caused by the power electronic drives for different, commonly used, control techniques, with the associated pulse patterns. Equations are given that approximate the electromagnetic forces on the stator, dependent on the spectrum of the power delivered to the machine (’time harmonics’) and the actual rotor and stator design (’spaceharmonics’). In addition, an overview is given clothe available literature on this topic.
Author
*Acoustics; Marine Propulsion; Machinery; Electromagnetism; Induction Motors*

**20020065348** Scripps Institution of Oceanography, Marine Physical Lab., La Jolla, CA USA
**Shallow Water Acoustic Backscatter and Reverberation Measurements Using a 68-kHz Cylindrical Array**
Gallaudet, Timothy C.; Jan. 2001; 231p; In English; Original contains color images
Contract(s)/Grant(s): N62271-97-G-0069
Report No.(s): AD-A403546; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche
The characterization of high frequency, shallow water acoustic backscatter and reverberation is important because acoustic systems are used in many scientific, commercial, and military applications. The approach taken is to use data collected by the Toroidal Volume Search Sonar (TVSS), a 68 kHz multibeam sonar capable of 360 deg imaging in a vertical plane perpendicular to its direction of travel. With this unique capability, acoustic backscatter imagery of the seafloor, sea surface, and horizontal and vertical planes in the volume is constructed from data obtained in 200 m deep waters in the Northeastern Gulf of Mexico when the TVSS was towed 78 m below the surface, 735 m astern of a towship. The processed imagery provides a quasi-synoptic characterization of the spatial and temporal structure of boundary and volume acoustic backscatter and reverberation. Diffraction, element patterns, and high sidelobe levels are shown to be the most serious problems affecting cylindrical arrays such as the TVSS, and an amplitude shading method is presented for reducing the peak sidelobe levels of irregular-line and non-coplanar arrays. Errors in the towfish’s attitude and motion sensor, and irregularities in the TVSS’s transmitted beampattern produce artifacts in the TVSS-derived bathymetry and seafloor acoustic backscatter imagery. Correction strategies for these problems are described, which are unique in that they use environmental information extracted from both ocean boundaries. Sea surface and volume acoustic backscatter imagery is used to explore and characterize the structure of near-surface bubble clouds, schooling fish, and zooplankton. The simultaneous horizontal and vertical coverage provided by the TVSS is shown to be a primary advantage, motivating further use of multibeam sonars in these applications.
DTIC
*Backscattering; Shallow Water; Acoustic Measurement*

**20020066343** Purdue Univ. Calumet, Hammond, IN USA
**Non-Linear Acoustic System for Damage Assessment**
Kin, Yulian, Purdue Univ. Calumet, USA; Sutin, Alexander, Purdue Univ. Calumet, USA; Roades, Eric, Purdue Univ. Calumet, USA; Dalton, Karen, Purdue Univ. Calumet, USA; Bateman, Kimberly, Purdue Univ. Calumet, USA; National Educators’ Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 435-440; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche
This project is based on a nonlinear acoustic approach to damage detection. This approach is based on the fact that cracks, surface flaws, disbonding or other damage have high nonlinear elasticity. This causes nonlinear acoustic responses, especially the modulation of an ultrasound wave passing through a crack. These responses were of particular interest in the conducted experiments. In these experiments, the specimens were induced with a high frequency ultrasonic wave and a low frequency vibration, and the interaction modulation provided a reliable measure of the quantity of the accumulated damage. This method is known as nonlinear wave modulation spectroscopy (NWMS). Damage assessment on the basis of wave modulation change is presented.
Derived from text
*Damage Assessment; Nonlinearity; Mechanical Properties; Acoustics; Fatigue (Materials)*

**20020066488** National Defence Research Establishment, Div. of Systems and Underwater Technology, Stockholm, Sweden
**Broadband Matched Field Localization: A Maximum Likelihood Approach**
Parastates, E.; Jan. 2000; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): PB2002-105110; FOA-R-00-01445-409-SE; No Copyright; Avail: National Technical Information Service (NTIS)

A broadband Matched Field Processing (MFP) scheme for localization and detection is introduced, based on the Maximum Likelihood (ML) method. Under the zero mean, Gaussian noise assumption, the ML estimate of the source position is obtained by a fit of a ray model to data in a least squares sense. The ray model is factorized in two parts in such a way that the first part can be used for localization, while the second part enters linearly, is singled out and solved for analytically. The resulting matched field processor is not affected by modeling errors in the linearly entering part. The processor is used in the design of a broadband beamformer, and a Likelihood Ratio Test (LRT). The beamforming can be used for the estimation of the source bearing and the number of paths of propagation. The LRT is used to distinguish between the real source and ambiguous maxima induced by noise. The scheme is applied successfully on shallow water experimental data, without any kind of a priori model calibration.
NTIS
*Broadband; Maximum Likelihood Estimates; Position (Location); Mathematical Models; Underwater Acoustics*

**20020066491** Automated Analysis Corp., Ann Arbor, MI USA
**The Imagery of Sound**
Spinoff 2000; 2000, pp. 62; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

Automated Analysis Corporation's COMET is a suite of acoustic analysis software for advanced noise prediction. It analyzes the origin, radiation, and scattering of noise, and supplies information on how to achieve noise reduction and improve sound characteristics. COMET's Structural Acoustic Foam Engineering (SAFE) module extends the sound field analysis capability of foam and other materials. SAFE shows how noise travels while airborne, how it travels within a structure, and how these media interact to affect other aspects of the transmission of noise. The COMET software reduces design time and expense while optimizing a final product's acoustical performance. COMET was developed through SBIR funding and Langley Research Center for Automated Analysis Corporation.
Author
*Technology Utilization; Acoustic Measurement; Structural Engineering; Imaging Techniques; Noise Prediction*

## 72
## ATOMIC AND MOLECULAR PHYSICS

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

**20020065435** Lawrence Livermore National Lab., Livermore, CA USA
**Calculation of Antiproton-Hydrogen Atom Scattering**
Morgan, D. J.; Mar. 30, 1999; 14p; In English
Report No.(s): DE2002-791513; UCRL-JC-138304; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Being a three body problem, the scattering of an incoming antiproton <p(sup -) by a hydrogen atom (H, consisting of an electron, e<sup -, bound to a proton, p) is one of the simplest problems in quantum mechanics that requires a numerical solution. An appropriate choice of calculational method for this system depends on the energy of the p(sup -). Described and compared here are three methods, valid in essentially separate energy ranges from zero energy through MeV energies. In spite of its seeming simplicity, much effort is required in terms of mathematical manipulation and use of approximations to render this problem capable of numerical solution.
NTIS
*Antiprotons; Scattering; Computation; Hydrogen*

**20020065536** NASA Ames Research Center, Moffett Field, CA USA
**Ion-Molecule Reactions and Ion Kinetics in DC Townsend Discharges in Dielectric Gases**
Rao, M. V. V. S., NASA Ames Research Center, USA; [1998]; 1p; In English; 8th International Symposium on Gaseous Dialectrics, 2-5 Jun. 1998, Virginia Beach, VA, USA
Contract(s)/Grant(s): RTOP 632-10-01; No Copyright; Avail: Issuing Activity; Abstract Only

In gas discharges the identify, transport, relative intensities, and kinetic energy distributions (KEDs) of ions may be dominated by ion-molecule reactions. In order to understand these discharges, there is a need for cross section data for various ion-molecule reactions, including symmetric and asymmetric charge-transfer, collisional detachment, and ion conversion reactions, especially for low to intermediate ion-impact energies. In view of the importance of dielectric gases, we have recently measured the KEDs of various positive and negative ions produced in DC Townsend discharges in SF6, CF4, CHF3, O2, and CO2. The relative

abundance and mean energies of ions are obtained from the measured KEDs. The effective cross sections (Qeff) describing the KEDs of various ions can be derived by using the mean ion energies and the electric field-to-gas density ratios (E/N). In the case of SF6 and O2 discharges, the determined cross sections (Qeff) for the negative-ion molecule reactions are consistent with previously measured cross section data obtained by crossed-beam experiment. The availability of these cross section values enabled us to understand the ion data reasonably well. However, the lack of adequate cross section data for positive ions in all of the above gases is a major obstacle in understanding ion transport in these gas discharges.
Author
*Ionic Reactions; Molecular Interactions; Kinetics; Gas Discharges; Energy Distribution*

**20020066304** Fermi National Accelerator Lab., Batavia, IL USA
**Rare Kaon Decays (February 2002)**
Cooper, P. S.; Feb. 2002; In English; See also DE2001-14649
Report No.(s): DE2002-791969; FERMILAB-CONF-02/025E; No Copyright; Avail: National Technical Information Service (NTIS)

The subject of rare and ultra-rare kaons decays is very active at this time with 8 experiments from 4 labs reporting new results recently and 6 new experiments recently approved. The physics topics under study include flavor changing neutral currents (FCNC), measurements of direct and indirect CP violation and searches for lepton flavor violation (LFV). These measurements are all characterized by very high sensitivities, studying modes with branching ratios in the 10(exp -7)--10(exp -12) range with single event sensitivities approaching 10(exp -12). This is a region of sensitivity beyond the reach of charm and B experiment, at least for now. The development of beams with fluxes well above 1MHz of kaon decays enable these experiments. In this paper the author covers some of the important new results and the goals for the new experiments.
NTIS
*Kaons; Decay Rates; Neutral Currents*

**20020066502** Moldyn, Inc., Cambridge, MA USA
**Modeling Molecules**
Spinoff 2000; 2000, pp. 41; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

The molecule modeling method known as Multibody Order (N) Dynamics, or MBO(N)D, was developed by Moldyn, Inc. at Goddard Space Flight Center through funding provided by the SBIR program. The software can model the dynamics of molecules through technology which stimulates low-frequency molecular motions and properties, such as movements among a molecule's constituent parts. With MBO(N)D, a molecule is substructured into a set of interconnected rigid and flexible bodies. These bodies replace the computation burden of mapping individual atoms. Moldyn's technology cuts computation time while increasing accuracy. The MBO(N)D technology is available as Insight II 97.0 from Molecular Simulations, Inc. Currently the technology is used to account for forces on spacecraft parts and to perform molecular analyses for pharmaceutical purposes. It permits the solution of molecular dynamics problems on a moderate workstation, as opposed to on a supercomputer.
Author
*Molecular Dynamics; Computerized Simulation; Dynamic Models*

**20020066514** Argonne National Lab., IL USA
**Status of the VIM Monte Carlo Neutron/Photon Transport Code**
Blomquist, R. N.; 2002; 10p; In English
Report No.(s): DE2002-41885; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Recent work on the VIM Monte Carlo code has aimed at advanced data libraries, ease of use, availability to users outside of Argonne, and fission source convergence algorithms in eigenvalue calculations. VIM is one of three US Monte Carlo codes in the USDOE Nuclear Criticality Safety Program, and is available through RSICC and the NEA Data Bank.
NTIS
*Monte Carlo Method; Algorithms; Neutrons; Applications Programs (Computers); Photons*

**20020066571** Iowa State Univ. of Science and Technology, Ames, IA USA
**High-perpendicular Charged Particles Azimuthal Correlation in PHENIX**
Jan. 2002; 14p; In English
Report No.(s): DE2002-23972; BNL-69098; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A two-particle azimuthal correlation analysis of the PHENIX data taken at (radical)s(sub NN) = 130 GeV/c is discussed. A comparison of the magnitude of v(sub 2)(p(perpendicular)) extracted from the correlation analysis with those obtained from a reaction plane analysis by the STAR collaboration, indicate surprisingly small non-flow contributions. A similar comparison obtained from the CERES experiment at (radical)s(sub NN) = 17 GeV/c shows stronger non-flow contributions for a similar p(erpendicular)-range which can be attributed to the presence of mini-jets. It is argued that for the p(perpendicular)-range below 2-3 GeV/c the RHIC results may be indicative of a novel particle production mechanism related to low-x gluon saturation.
NTIS
*Charged Particles; Gluons*

**20020066610** California Univ., Lawrence Berkeley National Lab., Berkeley, CA USA
**Elastic Scattering of Low-Energy Electrons by Randomly Oriented and Aligned Molecules Influence of Full Non-Spherical Potentials**
Rolles, D.; Muino, R. D.; GarciadeAbajo, F. J.; Fadley, C. S.; VanHove, M. A.; Journal of Electron Spectroscopy and Related Phenomena; Oct. 03, 2000; Volumes 114-116, pp. 107-113; In English
Report No.(s): DE2002-793780; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Elastic scattering of low (10-50 eV) kinetic energy electrons from free diatomic molecules is studied using a single-center expansion of the full molecular potential. Dynamic exchange and polarization are included in a local form. The calculated elastic differential scattering cross-sections (DCS) for electron impact on CO and N2 are in good agreement with available experimental data. The importance of using the full molecular potential instead of a two-center potential approach is pointed out. These corrections are small for energies above 50 eV, but they become increasingly important at lower energies. When discussing the angular distributions of elastically-scattered electrons from oriented molecules (like surface adsorbates), we show that these corrections are particularly significant. The results have implications for other electron scattering problems such as those encountered in low-energy photoelectron diffraction from both core and valence levels.
NTIS
*Elastic Scattering; Angular Distribution; Electron Diffraction*

**20020066624** Argonne National Lab., IL USA
**New Magnetic Measurement System at the Advanced Photon Source**
Eidelman, Y.; Deriy, D.; Makarov, O.; Vasserman, I.; 2002; 8p; In English
Report No.(s): DE2002-42414; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
A new system for precise measurements of the field integrals and multipole components of the APS magnetic insertion devices is described. A stretched coil is used to measure magnetic field characteristics. The hardware includes a number of servomotors to move (translate or rotate) the coil and a fast data acquisition board to measure the coil signal. A PC under Linux is used as a control workstation. The user interface is written as a Tcl/tk script; the hardware is accessed from the script through a shared C-library. A description of the hardware system and the control program is given.
NTIS
*Magnetic Measurement; Photons; Servomotors; Computer Systems Programs*

**20020066733** NASA Goddard Space Flight Center, Greenbelt, MD USA
**Photoionization of the Fe Ions: Structure of the K-Edge**
Palmeri, P., NASA Goddard Space Flight Center, USA; Mendoza, C., NASA Goddard Space Flight Center, USA; Kallman, T., NASA Goddard Space Flight Center, USA; Bautista, M., Instituto Venezolano de Investigaciones Cientificas, Venezuela; [2002]; 16p; In English; Conference Organizing Committee: ROMA X-2002, 31 May 2002, Unknown; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
X-ray absorption and emission features arising from the inner-shell transitions in iron are of practical importance in astrophysics due to the Fe cosmic abundance and to the absence of traits from other elements in the nearby spectrum. As a result, the strengths and energies of such features can constrain the ionization stage, elemental abundance, and column density of the gas in the vicinity of the exotic cosmic objects, e.g. active galactic nuclei (AGN) and galactic black hole candidates. Although the observational technology in X-ray astronomy is still evolving and currently lacks high spectroscopic resolution, the astrophysical models have been based on atomic calculations that predict a sudden and high step-like increase of the cross section at the K-shell threshold (see for instance. New Breit-Pauli R-matrix calculations of the photoionization cross section of the ground states of Fe XVII in the region near the K threshold are presented. They strongly support the view that the previously assumed sharp edge behaviour is not correct. The latter has been caused by the neglect of spectator Auger channels in the decay of the resonances converging to the K threshold. These decay channels include the dominant KLL channels and give rise to constant widths

(independent of n). As a consequence, these series display damped Lorentzian components that rapidly blend to impose continuity at threshold, thus reformatting the previously held picture of the edge. Apparent broadened iron edges detected in the spectra of AGN and galactic black hole candidates seem to indicate that these quantum effects may be at least partially responsible for the observed broadening.
Author
*Photoionization; Iron; Metal Ions; Atoms; Images; X Ray Absorption*

**20020066754** Argonne National Lab., IL USA
**Suggestions for Benchmark Scenarios for MSSM Higgs Boson Searches at Hadron Colliders**
Carena, M.; Heinemeyer, S.; Wagner, C. E. M.; Weiglein, G.; Feb. 16, 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-42575; ANL-HEP-CP-02-017; FERMILAB-PUB-02/024-T; BNL-HET-02/7; No Copyright; Avail: National Technical Information Service (NTIS)

The Higgs boson search has shifted from LEP2 to the Tevatron and will subsequently initial states, the Higgs production are not at LEP2 to what they are at hadron colliders. We suggest new benchmark scenarios for the MSSM parameter space.
NTIS
*Higgs Bosons; Particle Collisions*

**20020067644** NASA Goddard Space Flight Center, Greenbelt, MD USA
**D-Wave Resonances in Positronium Hydride**
Drachman, Richard J., NASA Goddard Space Flight Center, USA; DiRienzi, Joseph, College of Notre Dame of Maryland, USA; [2002]; 1p; In English; International Conference on Atomic Physics, 28 Jul. - 2 Aug. 2002, Cambridge, MA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The problem of calculating the position and width of the lowest-lying (L = 0, 1) resonances in the Ps + H scattering system has recently been re-examined by the authors [1]. In the model used, resonances axe assumed generated by bound Rydberg states in the closed re-arranged channel [e(+) + H(-)]. This infinite series of Coulomb bound states are shifted somewhat by the coupling with the open scattering channel [Ps + H]. Estimates using this approach, first carried out by one of the authors [2] using a simple form of scattering wavefunction, indicated an anticipated small shift of resonance away from the Rydberg energy in the S-wave (L = 0). More recent results by Ho and Yan [3] using the complex-rotation method showed unexpected significant shifting in the P (L = 1) and D (L = 2)-wave resonance energies from their respective unperturbed values. Our re-calculation of the resonances [I I for L = 0 and I indicates that, in each case, reasonably consistent resonance energies are obtained by coupling the two lowest lying states (IS and 2S for L = 0 and 2P and 3P for L = 1). For each L it is the higher state (2S and 3P, respectively) that produces the resonance. The lower state (1S and 2P, respectively) is effective only in increasing the non-resonant phase shift. In this work we extend the model to L = 2 (D-waves). Our results show that, unlike the S and P-waves, the 313-state alone produces a resonant energy that is very close to the result of Yan and Ho [3]. Inclusion of the 4D-state produces a second resonance in the scattering system shifted up slightly from its unperturbed Rydberg energy.
Author
*Positronium; Hydrides; Resonance Scattering; P Waves; Wave Functions; Phase Shift*

## 73
## NUCLEAR PHYSICS

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

**20020065288** Hawaii Univ., Honolulu, HI USA
**International Accelerator School: Frontiers of Accelerator Technology *Final Report, 1994***
Harris, F. A.; Sep. 17, 1998; 12p; In English
Report No.(s): DE2002-761665; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The international accelerator school on Frontiers of Accelerator TechnoIogy was organized jointly by the US Particle Accelerator School (Dr. Mel Month and Ms. Marilyn Paul), the CERN Accelerator School, and the KEK Accelerator School, and was hosted by the University of Hawaii. The course was held on Maui, Hawaii, November 3-9, 1994 and was made possible in part by a grant from the Department of Energy under award number DE-FG03-94ER40875, AMDT MO06. The 1994 program

was preceded by similar joint efforts held at SantaMargherita di Pula, Sardinia in February 1985, South Padre Island, Texas in October 1986, Anacapri, Italy in October 1988, Hilton Head Island, South Carolina in October 1990, and Benalmedena, Spain in October/November 1992. The most recent program was held in Montreux, Switzerland in May 1998. The purpose of the program is to disseminate knowledge on the latest ideas and developments in the technology of particle accelerators by bringing together known world experts and younger scientists in the field. It is intended for individuals with professional interest in accelerator physics and technology, for graduate students, for post-dots, for those interested in accelerator based sciences, and for scientific and engineering staff at industrial fins, especially those companies specializing in accelerator components.
NTIS
*Schools; Particle Accelerators; Students*

**20020065356** Gillespie (George H.) Associates, Inc., Del Mar, CA USA
**Multimedia Accelerator Game, Volume 2** ***Final Report***
Gillespie, G. H.; Brown, N. A.; Lancaster, G. A.; Hill, B. W.; Dec. 18, 1998; 64p; In English
Report No.(s): DE2002-761680; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The objective of this cooperative project is to develop a set of innovative educational video clips to aid in teaching pre-college students about accelerators, detectors and nuclear and high energy physics. The video clips to be developed will be suitable for integration into a wide variety of multimedia presentation and educational materials.
NTIS
*Education; Video Equipment; High Energy Interactions; Particle Accelerators*

**20020065437** Continuous Electron Beam Accelerator Facility, Newport New, VA USA
**Update on Windows, Couplers, Higher-Order-Mode Damping and Intelocks**
Phillips, L.; 2001; 32p; In English
Report No.(s): DE2002-791729; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
One of the more consistently challenging problems associated with superconducting RF systems is the introduction of RF power to the cavity and the extraction of beam-induced high-order-mode power from the cavity. This usually involves the transmission of RF power between atmosphere and cavity vacuum spanning a substantial difference in temperature. Dielectric RF windows, usually ceramic, provide atmospheric barriers, and carefully designed thermal transitions of waveguide or coaxial line span the temperature difference while minimizing heat flow to the refrigeration system from conduction and RF losses. There are exceptions, such as a proposed dual-beam accelerator in which RF power is generated in a parallel cavity structure which is RF coupled to accelerating cavities in a common vacuum environment. Some machines such as the DARMSTADT linac do not generate enough higher order mode fields to disturb the beam and require no damping at all. The CEBAF cavity, originally designed for higher current storage ring application at Cornell, generates only a few tenths of a watt with the CEBAF beam which is small enough to be economically dissipated at the cavity temperature and within the cavity vacuum envelope avoiding the need for a window. In general, this is not the case and larger values of higher order mode power must be dissipated at some intermediate shield temperature or outside of the cryostat at 300 K. An example is the HOM extraction system developed at KEK which is shown.
NTIS
*Particle Accelerators; Radio Frequencies; Superconductivity; Couplers; Linear Accelerators*

**20020065442** Continuous Electron Beam Accelerator Facility, Newport New, VA USA
**CEBAF Cryomodule Commissioning in the South Linac**
Drury, M.; Lankford, H.; Lee, T.; Marshall, J.; Saulter, Q.; 2001; 12p; In English
Report No.(s): DE2002-791942; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
When complete, the Continuous Electron Beam Accelerator Facility will house a 4 GeV recirculating linear accelerator containing 42 1/4 cryomodules arrayed in two antiparallel linacs and an injector. Currently, 38 1/4 cryomodules have been installed. Each cryomodule contains eight superconducting niobium 5-cell rf cavities that operate at 1.497 GHz (1). A cryomodule must provide an energy gain of 20 MeV to the 200 micro-A beam (2). The resultant dynamic heat load must be less than 45 W. The cavity parameters that are measured during the commissioning process include the external Q's (Q(sub ext)) of the cavity ports, the unloaded Q (Q(sub 0)) of the cavity as a function of accelerating gradient, and the maximum operating gradient of the cavity (3). Finally, the mechanical tuners are cycled and characterized. A portable test stand allows local control of the rf system and provides automated data acquisition. During the period from April 1993 through September 1993, 16 of the 20 cryomodules

installed in the South Linac were commissioned. All cryomodules tested in the South Linac meet or exceed the CEBAF specifications. This paper describes the results of the commissioning of the first 10 cryomodules in the South Linac.
NTIS
*Linear Accelerators; Dynamic Loads; Test Stands; Electron Beams*

**20020065508** Aerospace Corp., Lab. Operations, El Segundo, CA USA
**MeV Magnetosheath Ions Energized at the Bow Shock**
Chang, S. W.; Scudder, J. D.; Kudela, K.; Spence, H. E.; Fennell, J. F.; Aug. 01, 2001; 37p; In English
Contract(s)/Grant(s): F04701-00-C-0009
Report No.(s): AD-A403702; TR-2000(8570)-6; SMC-TR-02-28; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
A causal relationship between mid-latitude magneto sheath energetic ions and bow shock magnetic previously established for ion energy up to 200 keV/e for the May 4, 1998, storm event. This study demonstrates that magneto sheath ions with energies above 200 keV up to 1 MeV simply extend the ion spectrum to form a power-law tail. Results of cross-correlation analysis suggest that these ions also come directly from the quasi-parallel bow shock, not the magnetosphere. This is confirmed by a comparison of energetic ion fluxes simultaneously measured in the magneto sheath and at the quasi-parallel bow shock when both regions are likely connected by the magnetic field lines. We suggest that ions are accelerated at the quasi-parallel bow shock to energies as high as 1 MeV and subsequently transported into the magneto sheath during this event.
DTIC
*Magnetic Fields; Shock Waves*

**20020066156** NASA Marshall Space Flight Center, Huntsville, AL USA
**Application of Molten Salt Reactor Technology to Nuclear Electric Propulsion Mission**
Patton, Bruce, NASA Marshall Space Flight Center, USA; Sorensen, Kirk, NASA Marshall Space Flight Center, USA; Jan. 02, 2002; 4p; In English; American Nuclear Society Meeting, 3-9 Jun. 2002, Hollywood, FL, USA; Sponsored by American Nuclear Society, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
Nuclear electric propulsion (NEP) and planetary surface power missions require reactors that are lightweight, operationally robust, and scalable in power for widely varying scientific mission objectives. Molten salt reactor technology meets all of these requirements and offers an interesting alternative to traditional gas cooled, liquid metal, and heat pipe space reactors.
Author
*Reactor Technology; Nuclear Electric Propulsion; Molten Salts; Power Reactors*

**20020066157** NASA Marshall Space Flight Center, Huntsville, AL USA
**Application of Molten Salt Reactor Technology to MMW In-Space NEP and Surface Power Missions**
Patton, Bruce, NASA Marshall Space Flight Center, USA; Sorensen, Kirk, NASA Marshall Space Flight Center, USA; Apr. 01, 2002; 4p; In English; ANS Annual Meeting: Embedded Topical - International Congress on Advanced Nuclear Power Plants; Session on Aerospace Nuclear Science and Technologies, 9-13 Jun. 2002, Hollywood, FL, USA; Sponsored by American Nuclear Society, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
Anticipated manned nuclear electric propulsion (NEP) and planetary surface power missions will require multimegawatt nuclear reactors that are lightweight, operationally robust, and scalable in power for widely varying scientific mission objectives. Molten salt reactor technology meets all of these requirements and offers an interesting alternative to traditional multimegawatt gas-cooled and liquid metal concepts.
Author
*Nuclear Electric Propulsion; Molten Salts; Reactor Technology*

**20020066158** NASA Marshall Space Flight Center, Huntsville, AL USA
**Potential Operating Orbits for the SAFE-400**
Houts, Mike, NASA Marshall Space Flight Center, USA; Kos, Larry, NASA Marshall Space Flight Center, USA; Poston, David, NASA Marshall Space Flight Center, USA; [2002]; 4p; In English; 2002 American Nuclear Society (ANS) Meeting-International Congress on Advanced Nuclear Power Plants (ICAPP), 9-13 Jun. 2002, Hollywood, FL, USA; Sponsored by American Nuclear Society, USA; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
Safety must be ensured during all phases of space fission system design, development, fabrication, launch, operation, and shutdown. One potential space fission system application is fission electric propulsion (FEP), in which fission energy is converted into electricity and used to power high efficiency (Isp is greater than 3000s) electric thrusters. For these types of systems it is important to determine which operational scenarios ensure safety while allowing maximum mission performance and flexibility.

Space fission systems are essentially non-radioactive at launch, prior to extended operation at high power. Once high power operation begins, system radiological inventory steadily increases as fission products build up. For a given fission product isotope, the maximum radiological inventory is typically achieved once the system has operated for a length of time equivalent to several half-lives. After that time, the isotope decays at the same rate it is produced, and no further inventory builds in. For an FEP mission beginning in Earth orbit, altitude and orbital lifetime increase as the propulsion system operates. Two simultaneous effects of fission propulsion system operation are thus (1) increasing fission product inventory and (2) increasing orbital lifetime. Phrased differently, as fission products build up, more time is required for the fission products to naturally convert back into non-radioactive isotopes. Simultaneously, as fission products build up, orbital lifetime increases, providing more time for the fission products to naturally convert back into non-radioactive isotopes. Operational constraints required to ensure safety can thus be quantified.
Author
*Electric Propulsion; Fission; Fission Products; Radioactive Isotopes; Spacecraft Propulsion*

**20020066418** Brookhaven National Lab., Riken BNL Research Center, Upton, NY USA
**Scientific Presentations: 8th Meeting of the Management Steering Committee of the Riken BNL Collaboration**
Mar. 2002; 164p; In English
Report No.(s): DE2002-793821; BNL-52658; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The RIKEN BNL Research Center (RBRC) was established in April 1997 at Brookhaven National Laboratory. It is funded by the 'Riiagaku Kenkyusho,' (RIKEN) The Institute of Physical and Chemical Research, of Japan. The Center is dedicated to the study of strong interactions, including hard QCD/spin physics, lattice QCD and RHIC (Relativistic Heavy Ion Collider) physics through nurturing of a new generation of young physicists. The Director of RBRC is Professor T. D. Lee. The first years were dedicated to the establishment of a theory group. This has essentially been completed consisting of Fellows, Postclocs, and RHIC Physics/University Fellows, with an active group of consultants. The center also organizes an extensive series of workshops on specific topics in strong interactions with an accompanying series of published proceedings. In addition, a 0.6 teraflops parallel processor computer has been constructed and operational since August 1998. It was awarded the Supercomputer 1998 Gordon Bell Prize for price performance. An active experimental group centered around the spin physics program at RHIC has subsequently also been established at RBRC. Members and participants of RBRC on occasion will develop articles such as this one, in the nature of a status report or a general review.
NTIS
*Conferences; Research Projects*

**20020066605** Naval Academy, Annapolis, MD USA
**Electronic Reliability and the Environmental Thermal Neutron Flux**
Clark, John D.; May 06, 2002; 95p; In English; Original contains color images
Report No.(s): AD-A403631; No Copyright; Avail: CASI; A05, Hardcopy
Boron, which is used in the manufacturing process of manufacturing, is highly sensitive to thermal neutrons. When ambient thermal neutrons originating from cosmic rays interact with the nucleus of boron, ionizing radiation is produced that can change the logic state of a cell on a microchip. This phenomenon is known as a Single Event Upset or Soft Error and is an important problem facing computer manufacturers. The goal of this project is to characterize the environmental thermal neutron flux with respect to electronic reliability by performing measurements of the thermal neutron flux in various locations at the USA Naval Academy and in surrounding sites. The measurements were based on the use of two He(sup 3) gas-proportional counters, one detector was bare while the other was shrouded with boron-impregnated rubber that shielded it from thermal neutrons. The different in the response between the two detectors yielded the thermal flux. The detectors were calibrated at the National Institute of Standards and Technology (NIST) and the Armed Forces Radiobiology Research Institute (AFRRI). This project produced a portable, NIST traceable, accurately calibrated thermal neutron detection system. Measurements with that system showed a relatively constant thermal neutron flux from cosmic rays at sea level.
DTIC
*Boron; Thermal Neutrons; Neutrons; Flux (Rate)*

**20020066609** California Univ., Lawrence Livermore Lab., Livermore, CA USA
**Radio-Isotope Production Using Laser Wakefield Accelerators**
Leemans, W. P.; Rodgers, D.; Catravas, P. E.; Geddes, C. G. R.; Fubiani, G.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-793799; No Copyright; Avail: National Technical Information Service (NTIS)

A 10 Hz, 10 TW solid state laser system has been used to produce electron beams suitable for radio-isotope production. The laser beam was focused using a 30 cm focal length f/6 off-axis parabola on a gas plume produced by a high pressure pulsed gas jet. Electrons were trapped and accelerated by high gradient wakefields excited in the ionized gas through the self-modulated laser wakefield instability. The electron beam was measured to contain in excess of 5 nC/bunch. A composite Pb/Cu target was used to convert the electron beam into x-rays which subsequently produced radio-isotopes through (x, n) reactions. Isotope identification through X-ray spectroscopy and half-life time measurements demonstrated that (61)Cu was produced which indicates that 20-25 MeV x-rays were produced, and hence electrons with energies greater than 25-30 MeV. The production of high energy electrons was independently confirmed using a bending magnet spectrometer.
NTIS
*Electron Beams; Isotopes; Particle Acceleration; High Energy Electrons; Gas Jets*

**20020066635** Brookhaven National Lab., Upton, NY USA
**Electron-Cloud Effects in High-Intensity Proton Accelerators**
Wei, J.; Macek, R. J.; 2002; 16p; In English
Report No.(s): DE2002-24071; BNL-69189; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
One of the primary concerns in the design and operation of high-intensity proton synchrotrons and accumulators is the electron cloud and associated beam loss and instabilities. Electron-cloud effects are observed at high-intensity proton machines like the Los Alamos National Laboratory's PSR and CERN's SPS, and investigated experimentally and theoretically. In the design of next-generation high-intensity proton accelerators like the Spallation Neutron Source ring, emphasis is made in minimizing electron production and in enhancing Landau damping. This paper reviews the present understanding of the electron-cloud effects and presents mitigation measures.
NTIS
*Electron Clouds; Protons; Accelerators; Spallation*

**20020067403** NASA Goddard Space Flight Center, Greenbelt, MD USA
**Regimes of Pulsar Pair Formation and Particle Energetics**
Harding, Alice K., NASA Goddard Space Flight Center, USA; Muslimov, Alexander G., ManTech International Corp., USA; Zhang, Bing, Pennsylvania State Univ., USA; [2002]; 22p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
We investigate the conditions required for the production of electron-positron pairs above a pulsar polar cap (PC) and the influence of pair production on the energetics of the primary particle acceleration. Assuming space-charge limited flow acceleration including the inertial frame-dragging effect, we allow both one-photon and two-photon pair production by either curvature radiation (CR) photons or photons resulting from inverse-Compton scattering of thermal photons from the PC by primary electrons. We find that,, while only the younger pulsars can produce pairs through CR, nearly all known radio pulsars are capable of producing pairs through non-resonant inverse-Compton scatterings. The effect of the neutron star equations of state on the pair death lines is explored. We show that pair production is facilitated in more compact stars and more a massive stars. Therefore accretion of mass by pulsars in binary systems may allow pair production in most of the millisecond purser population. We also find that two-photon pair production may be important in millisecond pursers if their surface temperatures are above approx. or equal to three million degrees K. Pursers that produce pairs through CRT wilt have their primary acceleration limited by the effect of screening of the electric field. In this regime, the high-energy luminosity should follow a L(sub HE) proportional to dot-E(sup 1/2, sub rot) dependence. The acceleration voltage drop in pursers that produce pairs only through inverse-Compton emission will not be limited by electric field screening. In this regime, the high-energy luminosity should follow a L(sub HE) proportional to dot-E(sub rot) dependence. Thus, older pursers will have significantly lower gamma-ray luminosity.
Author
*Pulsars; Pair Production; Particle Acceleration; Electron-Positron Pairs*

**20020067456** NASA Marshall Space Flight Center, Huntsville, AL USA
**RF Manipulation of Ions in the High Performance Antiproton Trap (HiPAT)**
Pearson, J. Boise, NASA Marshall Space Flight Center, USA; Martin, James J., NASA Marshall Space Flight Center, USA; Sims, William H., NASA Marshall Space Flight Center, USA; Chakrabarti, Suman, NASA Marshall Space Flight Center, USA; Lewis, Raymond A., Lewis (R.) Co., USA; [2002]; 1p; In English; Space Technology and Application International Forum (SPAIF) 2003, 2-6 Feb. 2003, Albuquerque, NM, USA; No Copyright; Avail: Issuing Activity; Abstract Only
The annihilation of antimatter provides the highest mass specific energy of any other known reaction. Proper harnessing of this energy holds great promise for future space propulsion systems. Many different propulsion concepts have been proposed that

take advantage of antimatter, either using matter-antimatter as the primary fuel, or as a 'spark plug' for fusion and fission systems. In order to begin to address these concepts experimentally, a method of storing and transporting antimatter must be developed. The High Performance Antiproton Trap (HiPAT) is a first-generation storage and transportation device designed to store and transport 10(exp 12) antiprotons with a storage half-life of 18 days. It uses a Penning-Malmberg ion trap with a 4T magnetic field and 20 kV potential. This will enable researchers much more flexibility in the design of antimatter experiments related to propulsion. Ions cannot be stored indefinitely in a real trap, as ion cloud instabilities develop from imperfections in manufacturing and misalignments in assembly. Previous work has been done at both the National Institute of Standards and University of California in San Diego in using RF (radio frequency) signals to both diagnose and confine the ion cloud. Two electrodes in the trap have been segmented to allow both reception and transmission of RF waves in the ion cloud. Experiments are underway to determine the number of ions and density in the cloud by "listening" to protons contained in the HiPAT. Currently we believe the density of ions stored in the trap is roughly 10(exp 15) m(exp -3). Development of non-destructive techniques is vital to the project goals, enabling continuous monitoring of the quantities stored in the system. Experimental work is also being done in identifying RF transmission frequencies that can manipulate the density of the cloud, by exchanging energy and momentum between the RF wave and the ions. Preliminary experiments have demonstrated this interaction.
Author
*Aerospace Systems; Annihilation Reactions; Antiprotons; Ion Traps (Instrumentation); Spacecraft Propulsion*

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## OPTICS

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

**20020065541** Institute for Human Factors TNO, Soesterberg, Netherlands
**Technical Specifications of the TNO Human Factors Head-slaved Viewing System** ***Interim Report Technische Specificaties van het TNO TM Hoofdvolgend Zichtsysteem***
vanErp, J. B. F., Institute for Human Factors TNO, Netherlands; Oving, A. B., Institute for Human Factors TNO, Netherlands; Apr. 29, 2002; 22p; In English
Contract(s)/Grant(s): 013.19346; TNO Proj. 788.1
Report No.(s): TD-2002-0092; TNO-TM-02-A023; Copyright; Avail: Issuing Activity
The purpose of the study was to determine and describe the relevant technical characteristics of the TNO Human Factors head slaved viewing system, which we use in human performance studies for driving in poor-visibility conditions. Methods: Besides presenting a description of the components, we measured important characteristics of the system such as the delay in the image channel and the gain and phase shift of the motion platform. Results: The results are a complete description of the relevant characteristics, including the delay in the image channel (2-4 frames), the field of view (45 deg (IT) x 34 deg (V)), the gain of the motion platform (e.g., greater than 0.8 for frequencies below 2 Hz for all platform degrees of freedom, at input levels up to approximately 3V), and the phase shift (delay smaller than 180 deg for frequencies below 10 Hz).
Author
*Field of View; Helmet Mounted Displays; Visibility; Tanks (Combat Vehicles); Human Performance*

**20020066389** NASA Marshall Space Flight Center, Huntsville, AL USA
**New and Improved Integrated Optical Design Analysis (IODA) Software Features**
Troy, Edward, SRS Technologies, USA; Moore, James D., Jr., SRS Technologies, USA; [2002]; 1p; In English; 2nd Annual Technology Days, 22-24 May 2002, Huntsville, AL, USA
Contract(s)/Grant(s): NASA Order H-34116-D; No Copyright; Avail: Issuing Activity; Abstract Only
New features have been added to IODA to support testing of lightweight optics. Algorithms have been developed to predict actuator influence functions and positions to correct for gravity loading effects. New features have also been added to import measured test data and to compare measured data with predicted data.
Author
*Design Analysis; Software Engineering; Optics; Data Integration*

**20020066451** Naval Academy, Annapolis, MD USA
**Characterization of an Optical Self-Homodyne DPSK Receiver**
Elmasry, Tarek; May 2002; 50p; In English; Original contains color images
Report No.(s): AD-A403361; No Copyright; Avail: CASI; A03, Hardcopy

The goal of this project was to create a digital optical demodulator capable of processing information propagating at high data rates in an optical fiber. by processing data at higher rates the information capacity of the channel can be increased. Most demodulators in commercial applications utilize electrical systems. When an optical signal propagating in a fiber optic channel arrives at the receiver, the optical to electrical signal conversion can significantly slow down the processing speed. by optically processing the signal just before the electrical receiver, information can be transmitted at higher data rates. Many methods of building an optical demodulator have been tried using different digital signal processing techniques. In this project a demodulator was designed for differential phase shift keyed (DPSK) data using self-homodyne coherent detection, without using a local oscillator. Local oscillators are often incorporated into coherent receivers to provide a phase reference for incoming data. by replacing the local oscillator with a 3 dB coupler and a delay line, the design of this receiver was simplified. In this configuration the incoming signal uses itself as the reference. Past work on this topic has been mostly theoretical. This project went further by successfully testing a hardware model. Much of the experimental work concentrated on ensuring that constructive and destructive interference occurred in 3 dB couplers. The receiver setup was extremely sensitive to vibration. Experiments had to be performed on a floating table and the receiver had to be enclosed to give proper environmental isolation. In addition to hardware testing of this receiver, computer simulation of the model was performed to determine required component parameters. It was found that the dominant limiting factor of the communication system was the line width of the laser.
DTIC
*Optical Equipment; Receivers; Demodulators; Digital Techniques; Fiber Optics*

**20020066524** NASA Marshall Space Flight Center, Huntsville, AL USA
**Radius of Curvature Measurements: An Independent Look at Accuracy Using Novel Optical Metrology**
Taylor, Bryon, NASA Marshall Space Flight Center, USA; Kahan, Mark, NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 2nd Annual Technology Days, 22-24 May 2002, Huntsville, AL, USA
Contract(s)/Grant(s): 1713-UAH-CM-001; RTOP 279-A2-00; No Copyright; Avail: Issuing Activity; Abstract Only
The AMSD (Advanced Mirror System Demonstrator) program mirror specifications include the ability to manufacture the mirror to a radius of curvature of 10 m +/- 1 mm and to control its radius at 30K to the same specification. Therefore, it is necessary for the Government Team to be able to measure mirror radius of curvature to an accuracy of better than 0.5 mm. This presentation discusses a novel optical metrology system for measuring radius of curvature.
Author
*Curvature; Mirrors; Metrology; Nonintrusive Measurement*

**20020066573** Alabama Univ., Huntsville, AL USA
**AMSD Test Plan**
Hadaway, James, Alabama Univ., USA; Reardon, Pat, Alabama Univ., USA; Geary, Joe, Alabama Univ., USA; Robinson, Brian, Alabama Univ., USA; Stahl, Phil, NASA Marshall Space Flight Center, USA; Eng, Ron, NASA Marshall Space Flight Center, USA; Keglely, Jeff, NASA Marshall Space Flight Center, USA; Cummings, Ramona, NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 2nd Annual Technology Days, 22-24 May 2002, Huntsville, AL, USA
Contract(s)/Grant(s): NCC8-200; No Copyright; Avail: Issuing Activity; Abstract Only
The overall government plan to verify compliance of AMSD mirror systems to the specifications as given in the contract Statement of Work will be presented. The plan will address test requirements, test hardware, AMSD-XRCF interfacing, government vs contractor responsibilities, tests to be carried out, test conduction, and test data reduction & reporting. Issues regarding input to the plan and schedule of plan milestones will also be addressed.
Author
*Mirrors; Performance Tests; Governments*

**20020066574** NASA Marshall Space Flight Center, Huntsville, AL USA
**MSFC Test Results for Selected Mirrors: Brush-Wellman/Goodrich 0.5 meter Joined-Beryllium Mirror; IABG 0.5 meter C/SiC Mirror; Xinetics 0.5 meter SiC Mirror; and Kodak 0.23 meter SiO2 Mirror**
Hadaway, James, Alabama Univ., USA; Blackwell, Lisa, Alabama Univ., USA; Matthews, Gary, Eastman Kodak Co., USA; Eng, Ron, NASA Marshall Space Flight Center, USA; Stahl, Phil, NASA Marshall Space Flight Center, USA; Hraba, John, NASA Marshall Space Flight Center, USA; Thornton, Gary, NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 2nd Annual Technology Days, 22-24 May 2002, Huntsville, AL, USA
Contract(s)/Grant(s): NCC8-200; No Copyright; Avail: Issuing Activity; Abstract Only

The results of cryo tests performed at the XRCF on the above mirrors will be presented. Each mirror was tested from room-temperature to around 30 K. The first three were tested together on a 3-mirror stand in the large chamber using the PhaseCam interferometer, while the Kodak mirror was tested in the small chamber using the EPI interferometer.
Author
*Beryllium; Cryogenics; Mirrors; Silicon Carbides*

**20020066575** NASA Marshall Space Flight Center, Huntsville, AL USA
**Overview of MSFC AMSD Integrated Modeling and Analysis**
Cummings, Ramona, NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 2nd Annual Technology Days, 22-24 May 2002, Huntsville, AL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Structural, thermal, dynamic, and optical models of the NGST AMSD mirror assemblies are being finalized and integrated for predicting cryogenic vacuum test performance of the developing designs. Analyzers in use by the MSFC Modeling and Analysis Team are identified, with overview of approach to integrate simulated effects. Guidelines to verify the individual models and calibration cases for comparison with the vendors' analyses are presented. In addition, baseline and proposed additional scenarios for the cryogenic vacuum testing are briefly described.
Author
*Mirrors; Systems Integration; Dynamic Models; Vacuum Tests; General Overviews*

**20020066576** NASA Marshall Space Flight Center, Huntsville, AL USA
**4D PhaseCam(Trade Mark) Capabilities: Modal Analysis and Multiple-Wavelength Mirror Phasing**
Millerd, James E., 4D Technology Corp., USA; Hayes, John B., 4D Technology Corp., USA; Schmucker, Mark, 4D Technology Corp., USA; [2002]; 1p; In English; 2nd Annual Technology Days, 22-24 May 2002, Huntsville, AL, USA
Contract(s)/Grant(s): NASA Order H-34880-D; No Copyright; Avail: Issuing Activity; Abstract Only

The PhaseCam is a dynamic phase shifting interferometer system manufactured by 4D Technology Corporation that is capable of very fast data acquisition. This rapid acquisition extends the capability of conventional interferometry to enable measurement in unstable environments, the generation of phase movies of surface shape and to facilitate modal analysis of structures. The PhaseCam hardware and software have been modified for MSFC to include synchronous modal optical measurement and analysis. These modifications will be discussed and data presented. The dynamic range of a phase shifting measurement is limited by local slope and pixel sampling to lambda/4 wave steps. Two-wavelength techniques can increase the effective measurement wavelength from microns to tens of centimeters and permit the phasing of mirror segments. A two wavelength PhaseCam will be discussed and measurement results presented.
Author
*Computer Programs; Dynamic Range; Mirrors; Phase Shift; Wavelengths; Modal Response*

**20020066577** Alabama Univ., Huntsville, AL USA
**Leica Absolute Distance Meter**
Hadaway, James, Alabama Univ., USA; Eng, Ron, NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 2nd Annual Technology Days, 22-24 May 20002, Huntsville, AL, USA
Contract(s)/Grant(s): NCC8-200; No Copyright; Avail: Issuing Activity; Abstract Only

The principle of operation and measured accuracy of the ADM will be presented. Results of the Acceptance Test will be reported.
Author
*Distance; Performance Tests; Measuring Instruments*

**20020066590** Cornerstone Research Group, Inc., USA
**Conformal Membrane Reflectors for Deployable Optics**
Hood, Patrick J., Cornerstone Research Group, Inc., USA; May 20, 2002; 1p; In English; 2nd Annual Technology Days, 22-24 May 2002, Huntsville, AL, USA
Contract(s)/Grant(s): NAS8-01115; No Copyright; Avail: Issuing Activity; Abstract Only

This presentation reports the Phase I results on NASA's Gossamer Spacecraft Exploratory Research and Technology Program. Cornerstone Research Group, Inc., the University of Rochester, and International Photonics Consultants collaborated to investigate the feasibility of free-standing, liquid-crystal-polymer (LCP) reflectors for integration into space-based optical systems. The goal of the program was to achieve large-diameter, broadband. reflective membranes that are resistant to the effects of space, specifically cryogenic environments and gamma-ray irradiation. Additionally, we assessed the applicability of utilizing

the technology as tight sails, since, by their very nature, these films offer high-reflectivity at specified wavelengths. Previous research programs have demonstrated all-polymer, narrow-band Specular reflectors and diffuse membrane reflectors. The feasibility of fabricating an all-polymer broadband specular reflector and a narrow-band specular membrane reflector was assessed in the Phase I Gossamer program. In addition, preliminary gamma irradiation studies were conducted to determine the stability of the polymer reflectors to radiation. Materials and process technology were developed to fabricate coupon-scale reflectors of both broad- and narrow-band specular reflectors in Phase 1. This presentation will report the results of these studies, including, the performance of a narrow-band specular membrane. Gamma irradiation exposures indicate limited impact on the optical performance although additional exposure studies are warranted. Plans to scale up the membrane fabrication process will be presented.
Author
*Membranes; Reflectors; Sails; Spacecraft Propulsion; Space Flight*

**20020066658** NASA Marshall Space Flight Center, Huntsville, AL USA
**Radius of Curvature of Off-Axis Paraboloids**
Robinson, Brian, NASA Marshall Space Flight Center, USA; Reardon, Patrick, NASA Marshall Space Flight Center, USA; Hadaway, James, NASA Marshall Space Flight Center, USA; Geary, Joseph, NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 2nd Annual Technology Days, 22-24 May 2002, Huntsville, AL, USA; Sponsored by NASA Marshall Space Flight Center, USA
Contract(s)/Grant(s): NCC8-200; No Copyright; Avail: Issuing Activity; Abstract Only
We present several methods for measuring the vertex radius of curvature of off-axis paraboloidal mirrors. One is based on least-squares fitting of interferometer output, one on comparison of sagittal and tangential radii of curvature, and another on measurement of displacement of the nulled test article from the ideal reference wave. Each method defines radius of curvature differently and, as a consequence, produces its own sort of errors.
Author
*Curvature; Displacement Measurement; Paraboloid Mirrors; Radii*

**20020066665** NASA Marshall Space Flight Center, Huntsville, AL USA
**AMSD Figure Certification Plan**
Reardon, Pat, Alabama Univ., USA; Hadaway, James, Alabama Univ., USA; Geary, Joe, Alabama Univ., USA; Stahl, Phil, NASA Marshall Space Flight Center, USA; Eng, Ron, NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 2nd Annual Technology Days, 22-24 May 2002, Huntsville, AL, USA; Sponsored by NASA Marshall Space Flight Center, USA
Contract(s)/Grant(s): NCC8-200; No Copyright; Avail: Issuing Activity; Abstract Only
The method planned for the surface figure error measurement of the AMSDs at the XRCF will be discussed. Alignment, surface figure measurement, gravity effects, vibration & temperature environment effects, total error analysis, and data output will be discussed.
Author
*Alignment; Environment Effects; Vibration Effects; Certification; Gravitation*

**20020066783** NASA Marshall Space Flight Center, Huntsville, AL USA
**Development of the Ultra-Light Stretched Lens Array**
O'Neill, M. J., Entech, Inc., USA; McDanal, A. J., Entech, Inc., USA; George, P. J., NASA Glenn Research Center, USA; Piszczor, M. F., NASA Glenn Research Center, USA; Edwards, D. L., NASA Marshall Space Flight Center, USA; Botke, M. M., Able Engineering Co., Inc., USA; Jaster, P. A., Minnesota Mining and Mfg. Co., USA; Brandhorst, H. W., Auburn Univ., USA; Eskenazi, M.I., Able Engineering Co., Inc., USA; [2002]; 4p; In English; 29th IEEE Photovoltaic Specialists Meeting, 20-24 May 2002, New Orleans, LA, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
At the last IEEE (Institute of Electrical and Electronics Engineers) PVSC (Photovoltaic Specialists Conference), the new stretched lens array (SLA) concept was introduced. Since that conference, the SLA team has made significant advances in the SLA technology, including component level improvements, array level optimization, space environment exposure testing, and prototype hardware fabrication and evaluation. This paper will describe the evolved version of the SLA, highlighting the improvements in the lens, solar cell, rigid panel structure, and complete solar array wing. The near term SLA will provide

outstanding wing level performance: greater than 180 W/kg specific power, greater than 300 W/sq m power density, greater than 300 V operational voltage, and excellent durability in the space environment.
Author
*Solar Arrays; Conferences; Fresnel Lenses; Spacecraft Power Supplies; Satellite Solar Power Stations; Thin Films; Stretching; Solar Power Satellites*

**20020067358** NASA Marshall Space Flight Center, Huntsville, AL USA
**Fabry-Perot Interferometer-Based Electrooptic Modulator using LiNbO3 and Organic Thin Films**
Banks, C., NASA Marshall Space Flight Center, USA; Frazier, D., NASA Marshall Space Flight Center, USA; Penn, B., NASA Marshall Space Flight Center, USA; Abdeldayem, H., NASA Marshall Space Flight Center, USA; Sharma, A., Alabama Agricultural and Mechanical Univ., USA; Yelleswarapu, C., Alabama Agricultural and Mechanical Univ., USA; Leyderman, Alexander, Puerto Rico Univ., Puerto Rico; Correa, Margarita, Puerto Rico Univ., Puerto Rico; [2002]; 1p; In English; 5th International Conference on Application of Photonic Technology (ICAPT), 2 Jun. 2002, Quebec, Canada; No Copyright; Avail: Issuing Activity; Abstract Only

We report the study of a Fabry-Perot electro-optical modulator using thin crystalline film NPP, and Crystalline LiNbO3. We are able to observe 14, and 60 percent degree of modulation. Measurements were carried using a standard lock-in amplifier with a silicon detector. The proposal to design a Fabry-Perot electro-optic modulator with an intracavity electro-optically active organic material was based on the initial results using poled polymer thin films. The main feature of the proposed device is the observation that in traditional electrooptic modulators like a Packets cell, it requires few kilovolts of driving voltage to cause a 3 dB modulation even in high figure-of-merit electrooptic materials like LiNbO3. The driving voltage for the modulator can be reduced to as low as 10 volts by introducing the electrooptic material inside die resonant cavity of a Fabry-Perot modulator. This is because the transmission of the Fabry-Perot cavity varies nonlinearly with the change of refractive index or phase of light due to applied electric field.
Author
*Lithium Niobates; Fabry-Perot Interferometers; Electro-Optics; Thin Films; Modulators; Crystallinity*

**20020067396** SRS Technologies, Huntsville, AL USA
**Developments in Ultra Lightweight Membrane Optical Elements**
Patrick, Brian, SRS Technologies, USA; Moore, James D., Jr., SRS Technologies, USA; [2002]; 1p; In English; 2nd Annual Technology Days, 22-24 May 2002, Huntsville, AL, USA
Contract(s)/Grant(s): NASA Order H-34116-D; No Copyright; Avail: Issuing Activity; Abstract Only

25-micron polymer membranes have been fabricated with optical quality surface properties. Films of up to 17 inches in diameter have been manufactured with rms surface roughness of about 1.5 nanometer and subwavelength thickness variations. Current research is now focusing on figure control of these membrane optical elements.
Author
*Optical Properties; Membranes; Polymers*

**20020067399** NASA Marshall Space Flight Center, Huntsville, AL USA
**Interferometer for Testing in Vibration Environments**
Eng, Ron, NASA Marshall Space Flight Center, USA; Freischlad, Klaus, ADE Phase Shift, USA; Hadaway, James, Alabama Univ., USA; [2002]; 1p; In English; SPIE's 47th Annual Meeting: International Symposium on Optical Science and Technology, 7-11 Jul. 2002, Seattle, WA, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Temporal phase shifting interferometers require a stable environment during the data acquisition, so that well controlled phase steps can be introduced between successively acquired interferograms. In contrast, single-frame interferometers need to acquire only one interferogram to provide a phase map with very good precision at high spatial resolution. Thus these interferometers are well suited for the interferometric testing of large optics with long radius of curvature for which vibration isolation is difficult, eg. testing astronomical telescope mirrors in a test tower, or testing space optics inside a cryogenic vacuum chamber. This paper describes the Instantaneous Phase Interferometer (IPI) by ADE Phase Shift, together with measurement results at NASA. The IPI consists of a polarization Twyman-Green interferometer operating at 632.8 nm, with single-frame data acquisition based on a spatial carrier technique. The spatial carrier fringes are generated by introducing large amount of tilt between the test beam and the reference beam. The phase information of the optical surface under test is encoded in the straightness of the interference fringes, which can be detected in a single frame with spatial sampling of 1000 x 1000 pixels. Measurements taken at the NASA Marshall Space Flight Cater in support of the characterization of developmental optics for the Next Generation

Space Telescope are presented. Such tests consist of a mirror placed inside a cryogenic vacuum chamber, with the IPI placed outside the test chamber without any additional vibration isolation.
Author
*Interferometers; Interferometry; Vibration; Performance Tests*

**20020067404** NASA Goddard Space Flight Center, Greenbelt, MD USA
**X-ray versus Optical Variations in the Seyfert 1 Nucleus NGC 3516: A Puzzling Disconnectedness**
Maoz, Dan, Wise Observatory, Israel; Markowitz, Alex, California Univ., USA; Edelson, Rick, California Univ., USA; Nandra, Kirpal, NASA Goddard Space Flight Center, USA; [2002]; 20p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present optical broadband (B and R) observations of the Seyfert 1 nucleus NGC 3516, obtained at Wise Observatory from March 1997 to March 2002, contemporaneously with X-ray 2-10 keV measurements with RXTE. With these data we increase the temporal baseline of this dataset to 5 years, more than triple to the coverage we have previously presented for this object. Analysis of the new data does not confirm the 100-day lag of X-ray behind optical variations, tentatively reported in our previous work. Indeed, excluding the first year's data, which drive the previous result, there is no significant correlation at any Lag between the X-ray and optical bands. We also find no correlation at any lag between optical flux and various X-ray hardness ratios. We conclude that the close relation observed between the bands during the first year of our program was either a fluke, or perhaps the result of the exceptionally bright state of NGC 3516 in 1997, to which it has yet to return. Reviewing the results of published joint X-ray and UV/optical Seyfert monitoring programs, we speculate that there are at least two components or mechanisms contributing to the X-ray continuum emission up to 10 key: a soft component that is correlated with UV/optical variations on timescales approx. greater than 1 day, and whose presence can be detected when the source is observed at low enough energies (approx. 1 keV), is unabsorbed, or is in a sufficiently bright phase; and a hard component whose variations are uncorrelated with the UV/optical.
Author
*X Rays; Emission; Seyfert Galaxies; Broadband*

**20020067446** NASA Marshall Space Flight Center, Huntsville, AL USA
**COI NMSD Hybrid Mirror**
Mehle, Greg, NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 2nd Annual Technology Days, 22-24 May 2002, Huntsville, AL, USA
Contract(s)/Grant(s): NAS8-97310; No Copyright; Avail: Issuing Activity; Abstract Only

This presentation provides an overview of the development of the 1.6 meter hybrid mirror demonstrator for the NGST Mirror System Demonstrator (NMSD) program. The COI design approach for the NGST program combines the optical performance of glass, with the high specific stiffness capabilities of composite materials The foundation technologies being exploited in the development of the hybrid mirror focus upon precision Composite Materials for cryogenic operation, and non-contact optical processing (ion figuring) of the lightweight mirror surface. The NGST Mirror System Demonstrator (NMSD) has been designed and built by Composite Optics, Inc. (COI) with optical processing performed by SAGEM (REOSC). The sponsors of these efforts are the NASA Marshall and Goddard Space Flight Centers.
Author
*Mirrors; Optical Materials; Cryogenics; Proving*

**20020067457** NASA Marshall Space Flight Center, Huntsville, AL USA
**Goodrich Electro-Optical Systems AMSD Progress Update and Test Plans**
Garcia, Enrique, Goodrich (B. F.) Co., USA; Furber, Mark, Goodrich (B. F.) Co., USA; May 22, 2002; 1p; In English; 2nd Annual NASA Technology Days, 22-23 May 2002, Huntsville, AL, USA
Contract(s)/Grant(s): NAS8-00147
Report No.(s): VG-H26-0068; VG-H26-0069; No Copyright; Avail: Issuing Activity; Abstract Only

The goal of the Advanced Mirror System Demonstrator (AMSD) program is to develop and demonstrate technology for low mass primary mirror systems that can be produced at low cost and with short manufacturing times. In addition, specific performance objectives must be demonstrated at ambient and cryogenic temperatures. The Goodrich approach for AMSD is based on a thin facesheet supported through an array of figure-control actuators by a passive, stiff reaction structure. The facesheet is fused silica figured to the desired sphere by a novel process referred to as Stressed Mirror Polishing and light-weighted by water

jet milling. The mirror facesheet and the reaction structure are CTE-matched For cryogenic operation. Progress update on the design, the fabrication and the test plans, both ambient and cryogenic, will be presented.
Author
*Electro-Optics; Cryogenics; Mirrors; Low Cost; Actuators*

**20020067584** NASA Marshall Space Flight Center, Huntsville, AL USA
**Fabrication of Fiber-Optic Tilted Bragg Grating Filter in 40 nm Range with A Single Phase Mask**
Grant, Joseph, NASA Marshall Space Flight Center, USA; Wang, Y., Alabama Agricultural and Mechanical Univ., USA; Sharma, A., Alabama Agricultural and Mechanical Univ., USA; [2002]; 1p; In English; Photonics North 2002 Conference, 2-6 Jun. 2002, Quebec, Canada
Contract(s)/Grant(s): RTOP 274-14-00; No Copyright; Avail: Issuing Activity; Abstract Only

Fiber-optic Bragg grating filters are fabricated with a range of Bragg wavelength between 1296 and 1336 nm, using a single phase mask. 30 mW of continuous-wave light at 244 nm is used from a frequency-doubled argon-ion laser having an intracavity etalon. Gratings are fabricated by tilting the photosensitive fiber with respect to the phase mask up to an angle of 15 degrees. The variation of Bragg wavelength with the fiber-tilt is explained with a simple formula. High spatial coherence of 244 nm light makes it possible to displace the fiber as much as 6 mm in front of the phase mask and tilt the fiber by as much as 15 degrees. This results in nearly constant band-width and near 100% reflectively for all gratings throughout the 40 nm range.
Author
*Argon Lasers; Bragg Gratings; Fabrication; Fiber Optics; Etalons*

**20020067631** NASA Marshall Space Flight Center, Huntsville, AL USA
**Status of NASA Mirror Technology Development for Large Space Telescopes**
Stahl, H. Philip, NASA Marshall Space Flight Center, USA; [2001]; 1p; In English; 2nd Annual Technology Days, 22-24 May 2002, Huntsville, AL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

This paper presents the current status of several NASA technology development activities, including: Sub-scale Beryllium Mirror Demonstrator (SBMD), NGST (Next Generation Space Telescope) Mirror System Demonstrator (NMSD), Advanced Mirror System Demonstrator (AMSD), etc.. It also describes how these activities map into future NASA mission requirements, including: Next Generation Space Telescope (NGST), Single Aperture Far Infrared Observatory (SAFIR), Space Ultraviolet/Optical Observatory (SUVO), etc..
Author
*Spaceborne Telescopes; Space Missions; Spaceborne Astronomy*

**20020067640** NASA Marshall Space Flight Center, Huntsville, AL USA
**Measurements of Optically Transparent and Mirrored Specimens from the POSA and EOIM III Space Flight Experiments**
Pippin, Gary, Boeing Phantom Works, USA; Finckenor, Miria, NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; SPIE 47th Annual International Symposium on Optical Science and Technology, 7-11 Jul. 2002, Seattle, WA, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

A selected set of optically transparent specimens and first surface mirror specimens have been examined subsequent to on-orbit exposure. Certain specimens were from the Passive Optical Sample Assembly I and II experiments flown on the MIR Space Station. Other specimens were from the Energetic Oxygen Interaction with materials III experiment flown on the STS in August 1992. A comparison of pre- and post-flight transmission of reflectance measurements, as appropriate, has been carried out. Data from different specimens includes results of measurements for IR, optical, UV and/or vacuum UV wavelength intervals. Results of these measurements clearly show the effects of molecular contamination deposits on the surfaces during the on-orbit exposures. Surface analysis on a attracted set of specimens provides and estimate of contaminant thickness and composition and provides an insight into on-orbit deposition rates and surface oxidation reactions. For both the EOIM III and POSA I & II experiments, the primary source of contamination were outgassed silicones. Both experiments received approximately the same fluence of atomic oxygen (approx. 1-2 x 1020 atoms per square centimeter). ROSA specimens received between approx. 400 and 580 equivalent sun hours (ESH) of solar radiation over an 18 month period in orbit. The EOIM specimens were on an STS flight of about 1 week duration and received only approx. 5-10 ESH of solar radiation.
Author
*Mir Space Station; Solar Radiation; Spaceborne Experiments; Transparence; Oxidation*

**20020067655** NASA Marshall Space Flight Center, Huntsville, AL USA

**Progress Report on the University of Arizona NGST Mirror System Demonstrator**

Baiocchi, Dave, NASA Marshall Space Flight Center, USA; Burge, Jim, NASA Marshall Space Flight Center, USA; Cuerden, Brian, NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 2nd Annual Technology Days, 22-24 May 2002, Huntsville, AL, USA

Contract(s)/Grant(s): NAS8-97309; No Copyright; Avail: Issuing Activity; Abstract Only

We will present an update for the University of Arizona NGST (Next Generation Space Telescope) Mirror System Demonstrator (NMSD). The 2-m, f/5 NMSD mirror uses a 2 mm thick glass substrate and an actuated lightweight structure for surface accuracy and support. We will review the mirror's basic design and summarize the fabrication process. We will also discuss the current results from system integration and testing.

Author

*Spaceborne Telescopes; Mirrors; Actuators; Design Analysis; Fabrication*

## 75
## PLASMA PHYSICS

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

**20020065291** Rochester Univ., Lab. for Laser Energetics, NY USA

**LLE *Annual Report, Oct. 1998 - Sep. 1999***

Jan. 2000; 252p; In English

Report No.(s): DE2002-762172; DOE/SF/19460-332; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The fiscal year ending September 1999 (FY99) concluded the second year of the cooperative agreement (DE-FC03-92SF19460) five-year renewal with the U. S. Department of Energy (DOE). This report summarizes research at the Laboratory for Laser Energetic (LLE), the operation of the National Laser Users' Facility (NLUF), and programs involving education of high school, undergraduate, and graduate students for FY99.

NTIS

*Lasers; Laboratories; Agreements; Inertial Fusion (Reactor); Education*

**20020065357** General Atomics Co., San Diego, CA USA

**Determination of the Electron Cyclotron Current Drive Profile**

Luce, T. C.; Petty, C. C.; Schuster, D. I.; Makowski, M. A.; Nov. 1999; 14p; In English

Report No.(s): DE2002-766680; GA-A-23259; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Evaluation of the profile of non-inductive current density driven by absorption of electron cyclotron waves (ECCD) using time evolution of the poloidal flux indicated a broader profile than predicted by theory. to determine the nature of this broadening, a 1-1/2 D transport calculation of current density evolution was used to generate the signals which the DIII-D motional Stark effect (MSE) diagnostic would measure in the event that the current density evolution followed the neoclassical Ohm's law with the theoretical ECCD profile. Comparison with the measured MSE data indicates the experimental data is consistent with the ECCD profile predicted by theory. The simulations yield a lower limit on the magnitude of the ECCD which is at or above the value found in Fokker-Planck calculations of the ECCD including quasilinear and parallel electric field effects.

NTIS

*Current Density; Heating; Cyclotron Radiation; Evaluation; Geometry*

**20020065358** General Atomics Co., San Diego, CA USA

**Reduction of Carbon Influx by Minimizing Tile Heating in DIII-D**

Friend, M. E.; Baxi, C. B.; Mahdavi, M. A.; O'Neill, R. C.; Nov. 1999; 12p; In English

Report No.(s): DE2002-766645; GA-A23277; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

As predicted by theoretical models, under certain plasma configurations the edges of the graphite tiles lining the walls of the DIII-D vacuum vessel can exceed 2000 deg C. This is the temperature at which ablation occurs for the ATJ graphite material for localized heating (1500 deg C for the face of the tile) and thus represents an operational limit for the tokamak. This theoretical prediction is confirmed by observed increased carbon contamination in the plasma and wearing of the tile edges. Several approaches were investigated to minimize tile edge heating by reducing the amount of heat flux on the tiles toroidal and poloidal

surfaces. This was accomplished by modifying the geometry of the top two rows of the DIII-D centermost tiles. For the toroidal surfaces, the geometry of the tile was changed from a facetted to a curved configuration, thereby reducing the angle of surface relative to the plasma field line.
NTIS
*Carbon; Heat Flux; Tokamak Devices*

**20020065446** General Atomics Co., San Diego, CA USA
**Helium-Cooled Refractory Alloys First Wall and Blanket Evaluation**
Wong, C. P. C.; Nygren, R. E.; Baxi, C. B.; Fogerty, P.; Ghoniem, N.; Aug. 1999; 30p; In English
Report No.(s): DE2002-766826; GA-A23177; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Under the APEX program the He-cooled system design task is to evaluate and recommend high power density refractory alloy first wall and blanket designs and to recommend and initiate tests to address critical issues. We completed the preliminary design of a helium-cooled, W-5Re alloy, lithium breeder design and the results are reported in this paper. Many areas of the design were assessed, including material selection, helium impurity control, and mechanical, nuclear and thermal hydraulics design, and waste disposal, tritium and safety design. System study results show that at a closed cycle gas turbine (CCGT) gross thermal efficiency of 57.5%, a superconducting coil tokamak reactor, with an aspect ratio of 4, and an output power of 2 GWe, can be projected to have a cost of electricity at 54.6 mill/kWh. Critical issues were identified and we plan to continue the design on some of the critical issues during the next phase of the APEX design study.
NTIS
*Helium; Refractory Metals; Blankets; Cooling; Evaluation; Walls*

**20020066403** Argonne National Lab., IL USA
**Plasma Considerations in the IPNS RCS**
Dooling, J. C.; McMichael, G. E.; Brumwell, F. R.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-793055; No Copyright; Avail: National Technical Information Service (NTIS)

Significant ionization appears to occur in the Rapid Cycling Synchrotron (RCS) during its 14 ms acceleration period leading to plasma formation and neutralization. The beam may in fact be over-neutralized, causing the tune to increase during the acceleration cycle. The overall tune shift in the RCS appears to be close to +0.5. The presence of plasma may help explain why longitudinal phase modulation can so quickly couple to transverse motion. In addition, plasmas tend to be inductive and the RCS appears to exhibit a relatively high inductance. Measurements of the electron cloud and plasma densities adjacent to the beam should be made. In addition to the RFA and Swept Analyzer diagnostics mentioned at the Workshop, other techniques might be attempted. If plasma is present, then a small, biased-probe might be useful (e.g., a Langmuir probe), or with the proper choice of geometry, an optics-based measurement for line density (e.g., an interferometer) might be employed, perhaps using microwaves for increased sensitivity.
NTIS
*Particle Accelerators; Plasmas (Physics); Ionization; Synchrotrons; Plasma Density*

**20020066439** Plasma Processes, Inc., Huntsville, AL USA
**A New Way to Spray**
Spinoff 2000; 2000, pp. 83; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

A NASA SBIR contract provided the funding for a new nozzle shape to be used in plasma spray techniques. The new design, a bell shape, reduces overspray. The result is a significant decrease in the cost of plasma spraying and a higher quality, more pure coating.
Author
*Technology Utilization; Plasma Spraying; Sprayed Coatings; Spray Nozzles*

**20020066592** NASA Marshall Space Flight Center, Huntsville, AL USA
**A Physics Exploratory Experiment on Plasma Liner Formation**
Thio, Y. C. Francis, NASA Marshall Space Flight Center, USA; Knapp, Charles E., Los Alamos National Lab., USA; Kirkpatrick, Ronald C., Los Alamos National Lab., USA; Siemon, Richard E., Los Alamos National Lab., USA; Turchi, Peter, Air Force Research Lab., USA; [2002]; 23p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Momentum flux for imploding a target plasma in magnetized target fusion (MTF) may be delivered by an array of plasma guns launching plasma jets that would merge to form an imploding plasma shell (liner). In this paper, we examine what would be a worthwhile experiment to do in order to explore the dynamics of merging plasma jets to form a plasma liner as a first step in establishing an experimental database for plasma-jets driven magnetized target fusion (PJETS-MTF). Using past experience in fusion energy research as a model, we envisage a four-phase program to advance the art of PJETS-MTF to fusion breakeven Q is approximately 1). The experiment (PLX (Plasma Liner Physics Exploratory Experiment)) described in this paper serves as Phase I of this four-phase program. The logic underlying the selection of the experimental parameters is presented. The experiment consists of using twelve plasma guns arranged in a circle, launching plasma jets towards the center of a vacuum chamber. The velocity of the plasma jets chosen is 200 km/s, and each jet is to carry a mass of 0.2 mg - 0.4 mg. A candidate plasma accelerator for launching these jets consists of a coaxial plasma gun of the Marshall type.
Author
*Plasma Jets; Plasma Physics; Plasmas (Physics); Particle Accelerator Targets*

**20020066631** Argonne National Lab., IL USA
**Leakage Analysis of the Evolve First Wall**
Majumdar, S.; Jan. 2002; 18p; In English
Report No.(s): DE2002-41922; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Leakage of lithium through cracks in the first wall of EVOLVE was analyzed for two limiting cases, which are simplified versions of the real case, where the lithium enters the cracks as liquid and flashes to vapor phase within the first wall. Leakage rates were calculated for the cases of liquid lithium flow and lithium vapor flow. Inasmuch as the coolant pressure is close to the saturation pressure, the limiting case of lithium vapor flow should be closer to reality. The impact of lithium leakage on first-wall cooling and plasma contamination is discussed.
NTIS
*Leakage; Coolants; Metal Vapors; Liquid Lithium*

**20020066632** Argonne National Lab., IL USA
**Liquid Metal Flows in Circular Insulated Ducts in Nonuniform Magnetic Fields**
Molokov, S.; Reed, C. B.; 2002; 22p; In English
Report No.(s): DE2002-42096; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Magnetohydrodynamic flows in insulated circular ducts in nonuniform magnetic fields are studied with reference to liquid metal blankets and divertors of fusion reactors. Particular emphasis is made on C-MOD. The ducts are supposed to be straight, while the gradient of the magnetic field to be inclined by an angle (alpha) to the duct axis. The results are presented for the values of the Hartmann numbers, Ha, of 1000 and 100. Three-dimensional pressure drop, development length, three-dimensional length and nonuniformities of the velocity profiles have been evaluated. It has been shown that for Ha = 1000 the three-dimensional effects are of considerable importance, while for Ha = 100 they may be neglected.
NTIS
*Ducts; Liquid Metals; Nonuniform Magnetic Fields; Magnetohydrodynamic Flow*

**20020067389** NASA Marshall Space Flight Center, Huntsville, AL USA
**Progress In Plasma Accelerator Development for Dynamic Formation of Plasma Liners**
Thio, Y. C. Francis, NASA Marshall Space Flight Center, USA; Eskridge, Richard, NASA Marshall Space Flight Center, USA; Martin, Adam, NASA Marshall Space Flight Center, USA; Smith, James, NASA Marshall Space Flight Center, USA; Lee, Michael, NASA Marshall Space Flight Center, USA; Cassibry, Jason T., Alabama Univ., USA; Griffin, Steven, Memphis State Univ., USA; [2002]; 1p; In English; American Nuclear Society (ANS) Meeting, 9-13 Jun. 2002, Hollywood, FL, USA; Sponsored by American Nuclear Society, USA; Original contains color illustrations; No Copyright; Avail: Issuing Activity; Abstract Only
An experimental plasma accelerator for magnetic target fusion (MTF) applications under development at the NASA Marshall Space Flight Center is described. The accelerator is a coaxial pulsed plasma thruster (Figure 1). It has been tested experimentally and plasma jet velocities of approx.50 km/sec have been obtained. The plasma jet has been photographed with 10-ns exposure times to reveal a stable and repeatable plasma structure (Figure 2). Data for velocity profile information has been obtained using light pipes and magnetic probes embedded in the gun walls to record the plasma and current transit respectively at various barrel locations. Preliminary spatially resolved spectral data and magnetic field probe data are also presented. A high speed triggering

system has been developed and tested as a means of reducing the gun ”jitter”. This jitter is being characterized and future work for second generation ”ultra-low jitter” gun development is being identified.
Author
*Plasma Accelerators; Pulsed Plasma Thrusters; Emission Spectra; Magnetic Fields; Modulation Transfer Function; Plasma Currents*

**20020067390** NASA Marshall Space Flight Center, Huntsville, AL USA
**Magnetized Target Fusion Driven by Plasma Liners**
Thio, Y. C. Francis, NASA Marshall Space Flight Center, USA; Kirkpatrick, Ronald C., Los Alamos National Lab., USA; Knapp, Charles E., Los Alamos National Lab., USA; [2002]; 2p; In English; American Nuclear Society (ANS) Meeting, 9-13 Jun. 2002, Hollywood, FL, USA; Sponsored by American Nuclear Society, USA; Orginial contains color illustrations; No Copyright; Avail: Issuing Activity; Abstract Only

Magnetized target fusion is an emerging, relatively unexplored approach to fusion for electrical power and propulsion application. The physical principles of the concept are founded upon both inertial confinement fusion (ICF) and magnetic confinement fusion (MCF). It attempts to combine the favorable attributes of both these orthogonal approaches to fusion, but at the same time, avoiding the extreme technical challenges of both by exploiting a fusion regime intermediate between them. It uses a material liner to compress, heat and contain the fusion reacting plasma (the target plasma) mentally. By doing so, the fusion burn could be made to occur at plasma densities as high as six orders of magnitude higher than conventional MCF such as tokamak, thus leading to an approximately three orders of magnitude reduction in the plasma energy required for ignition. It also uses a transient magnetic field, compressed to extremely high intensity (100’s T to 1000T) in the target plasma, to slow down the heat transport to the liner and to increase the energy deposition of charged-particle fusion products. This has several compounding beneficial effects. It leads to longer energy confinement time compared with conventional ICF without magnetized target, and thus permits the use of much lower plasma density to produce reasonable burn-up fraction. The compounding effects of lower plasma density and the magneto-insulation of the target lead to greatly reduced compressional heating power on the target. The increased energy deposition rate of charged-particle fusion products also helps to lower the energy threshold required for ignition and increasing the burn-up fraction. The reduction in ignition energy and the compressional power compound to lead to reduced system size, mass and R&D cost. It is a fusion approach that has an affordable R&D pathway, and appears attractive for propulsion application in the nearer term.
Author
*Fusion Propulsion; Magnetic Fields; Charged Particles; Controlled Fusion; Confinement; Plasma Control*

**20020067447** NASA Marshall Space Flight Center, Huntsville, AL USA
**A Concept for Directly Coupled Pulsed Electromagnetic Acceleration of Plasmas**
Thio, Y.C. Francis, NASA Marshall Space Flight Center, USA; Cassibry, Jason T., NASA Marshall Space Flight Center, USA; Eskridge, Richard, NASA Marshall Space Flight Center, USA; Smith, James, NASA Marshall Space Flight Center, USA; Wu, S. T., Alabama Univ., USA; Nov. 20, 2001; 1p; In English; 38th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 7-10 Jul. 2002, Indianapolis, IN, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Plasma jets with high momentum flux density are required for a variety of applications in propulsion research. Methods of producing these plasma jets are being investigated at NASA Marshall Space Flight Center. The experimental goal in the immediate future is to develop plasma accelerators which are capable of producing plasma jets with momentum flux density represented by velocities up to 200 km/s and ion density up to 10(exp 24) per cu m, with sufficient precision and reproducibility in their properties, and with sufficiently high efficiency. The jets must be sufficiently focused to allow them to be transported over several meters. A plasma accelerator concept is presented that might be able to meet these requirements. It is a self-switching, shaped coaxial pulsed plasma thruster, with focusing of the plasma flow by shaping muzzle current distribution as in plasma focus devices, and by mechanical tapering of the gun walls. Some 2-D MHD modeling in support of the conceptual design will be presented.
Author
*Plasma Jets; Plasma Accelerators; Magnetohydrodynamic Flow; Electromagnetic Acceleration; Pulsed Plasma Thrusters; Flux Density; Momentum*

**20020067575** NASA Marshall Space Flight Center, Huntsville, AL USA

**Investigation of Recombination Processes In A Magnetized Plasma**

Chavers, Greg, NASA Marshall Space Flight Center, USA; Chang-Diaz, Franklin, NASA Johnson Space Center, USA; [2002]; 1p; In English; AIAA 33rd Plasmadynamics and Lasers Conference, 20-23 May 2002, Maui, HI, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Interplanetary travel requires propulsion systems that can provide high specific impulse (Isp), while also having sufficient thrust to rapidly accelerate large payloads. One such propulsion system is the Variable Specific Impulse Magneto-plasma Rocket (VASIMR), which creates, heats, and exhausts plasma to provide variable thrust and Isp, optimally meeting the mission requirements. A large fraction of the energy to create the plasma is frozen in the exhaust in the form of ionization energy. This loss mechanism is common to all electromagnetic plasma thrusters and has an impact on their efficiency. When the device operates at high Isp, where the exhaust kinetic energy is high compared to the ionization energy, the frozen flow component is of little consequence; however, at low Isp, the effect of the frozen flow may be important. If some of this energy could be recovered through recombination processes, and re-injected as neutral kinetic energy, the efficiency of VASIMR, in its low Isp/high thrust mode may be improved. In this operating regime, the ionization energy is a large portion of the total plasma energy. An experiment is being conducted to investigate the possibility of recovering some of the energy used to create the plasma. This presentation will cover the progress and status of the experiment involving surface recombination of the plasma.

Author

*Plasma Engines; Propulsion System Configurations; Specific Impulse; Recombination Reactions; Magnetization; Plasma Dynamics*

**20020067588** NASA Marshall Space Flight Center, Huntsville, AL USA

**An Experimental Study of a Low-Jitter Pulsed Electromagnetic Plasma Accelerator**

Thio, Y. C. Francis, NASA Marshall Space Flight Center, USA; Lee, Michael, NASA Marshall Space Flight Center, USA; Eskridge, Richard, NASA Marshall Space Flight Center, USA; Smith, James, NASA Marshall Space Flight Center, USA; Martin, Adam, NASA Marshall Space Flight Center, USA; Nov. 20, 2001; 1p; In English; 38th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 7-10 Jul. 2002, Indianapolis, IN, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: Issuing Activity; Abstract Only

An experimental plasma accelerator for a variety of applications under development at the NASA Marshall Space Flight Center is described. The accelerator is a pulsed plasma thruster and has been tested experimentally and plasma jet velocities of approximately 50 kilometers per second have been obtained. The plasma jet structure has been photographed with 10 ns exposure times to reveal a stable and repeatable plasma structure. Data for velocity profile information has been obtained using light pipes embedded in the gun walls to record the plasma transit at various barrel locations. Preliminary spatially resolved spectral data and magnetic field probe data are also presented. A high speed triggering system has been developed and tested as a means of reducing the gun ”jitter”. This jitter has been characterized and future work for second generation ”ultra-low jitter” gun development is identified.

Author

*Plasma Accelerators; Pulsed Plasma Thrusters; Plasma Jets; Electromagnetism; Plasmas (Physics); Vibration*

**20020067630** NASA Marshall Space Flight Center, Huntsville, AL USA

**Magnetohydrodynamic Augmented Propulsion Experiment**

Litchford, Ron J., NASA Marshall Space Flight Center, USA; Cole, John, NASA Marshall Space Flight Center, USA; Lineberry, John, LyTec, LLC, USA; Chapman, Jim, LyTec, LLC, USA; Schmidt, Harold, LyTec, LLC, USA; [2002]; 1p; In English; 33rd Plasmadynamics and Lasers Conference, 20-23 May 2002, Maui, HI, USA; No Copyright; Avail: Issuing Activity; Abstract Only

A fundamental obstacle to routine space access is the specific energy limitations associated with chemical fuels. In the case of vertical take-off, the high thrust needed for vertical liftoff and acceleration to orbit translates into power levels in the 10 GW range. Furthermore, useful payload mass fractions are possible only if the exhaust particle energy (i.e., exhaust velocity) is much greater than that available with traditional chemical propulsion. The electronic binding energy released by the best chemical reactions (e.g., LOX/LH2 for example, is less than 2 eV per product molecule (approx. 1.8 eV per H2O molecule), which translates into particle velocities less than 5 km/s. Useful payload fractions, however, will require exhaust velocities exceeding 15 km/s (i.e., particle energies greater than 20 eV). As an added challenge, the envisioned hypothetical RLV (reusable launch vehicle) should accomplish these amazing performance feats while providing relatively low acceleration levels to orbit (2-3g maximum). From such fundamental considerations, it is painfully obvious that planned and current RLV solutions based on chemical fuels alone represent only a temporary solution and can only result in minor gains, at best. What is truly needed is a revolutionary approach that will dramatically reduce the amount of fuel and size of the launch vehicle. This implies the need for new compact high-power

energy sources as well as advanced accelerator technologies for increasing engine exhaust velocity. Electromagnetic acceleration techniques are of immense interest since they can be used to circumvent the thermal limits associated with conventional propulsion systems. This paper describes the Magnetohydrodynamic Augmented Propulsion Experiment (MAPX) being undertaken at NASA Marshall Space Flight Center (MSFC). In this experiment, a 1-MW arc heater is being used as a feeder for a 1-MW magnetohydrodynamic (MHD) accelerator. The purpose of the experiment is to demonstrate that an MHD accelerator can be an effective augmentation system for increasing engine exhaust velocity. More specifically, the experiment is intended to show that electromagnetic effects are effective at producing flow acceleration whereas electrothermal effects do not cause unacceptable heating of the working fluid. The MHD accelerator was designed as an externally diagonalized segmented Faraday channel, which will be inserted into an existing 2-tesla electromagnet. This allows the external power to be connected through two terminals thereby minimizing the complexity and cost associated with powering each segment independently. The design of the accelerator and other components in the flow path has been completed and fabrication activities are underway. This paper provides a full description of MAPX including performance analysis, design, and test plans, and current status.
Author
*Magnetohydrodynamics; Electromagnetic Acceleration; Vertical Takeoff; Arc Heating; Magnetohydrodynamic Generators; Thrust Augmentation; Propulsion System Configurations*

**20020067633** NASA Marshall Space Flight Center, Huntsville, AL USA
**Pulse Detonation Rocket MHD Power Experiment**
Litchford, Ron J., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 33rd Plasmadynamics and Lasers Conference, 20-23 May 2002, Maui, HI, USA; No Copyright; Avail: Issuing Activity; Abstract Only

A pulse detonation research engine (MSFC (Marshall Space Flight Center) Model PDRE (Pulse Detonation Rocket Engine) G-2) has been developed for the purpose of examining integrated propulsion and magnetohydrodynamic power generation applications. The engine is based on a rectangular cross-section tube coupled to a converging-diverging nozzle, which is in turn attached to a segmented Faraday channel. As part of the shakedown testing activity, the pressure wave was interrogated along the length of the engine while running on hydrogen/oxygen propellants. Rapid transition to detonation wave propagation was insured through the use of a short Schelkin spiral near the head of the engine. The measured detonation wave velocities were in excess of 2500 m/s in agreement with the theoretical C-J velocity. The engine was first tested in a straight tube configuration without a nozzle, and the time resolved thrust was measured simultaneously with the head-end pressure. Similar measurements were made with the converging-diverging nozzle attached. The time correlation of the thrust and head-end pressure data was found to be excellent. The major purpose of the converging-diverging nozzle was to configure the engine for driving an MHD generator for the direct production of electrical power. Additional tests were therefore necessary in which seed (cesium-hydroxide dissolved in methanol) was directly injected into the engine as a spray. The exhaust plume was then interrogated with a microwave interferometer in an attempt to characterize the plasma conditions, and emission spectroscopy measurements were also acquired. Data reduction efforts indicate that the plasma exhaust is very highly ionized, although there is some uncertainty at this time as to the relative abundance of negative OH ions. The emission spectroscopy data provided some indication of the species in the exhaust as well as a measurement of temperature. A 24-electrode-pair segmented Faraday channel and 0.6 Tesla permanent magnet assembly were then installed on Marshall Space Flight Center's (MSFC's) rectangular channel pulse detonation research engine. Magnetohydrodynamic (MHD) electrical power extraction experiments were carried out for a range of load impedances in which cesium hydroxide seed (dissolved in methanol) was sprayed into the gaseous oxygen/hydrogen propellants. Positive power extraction was obtained, but preliminary analysis of the data indicated that the plasma electrical conductivity is lower than anticipated and the near-electrode voltage drop is not negligible. It is believed that the electrical conductivity is reduced due to a large population of negative OH ions. This occurs because OH has a strong affinity for capturing free electrons. The effect of near-electrode voltage drop is associated with the high surface-to-volume ratio of the channel (1-inch by 1-inch cross-section) where surface effects play a dominant role. As usual for MHD devices, higher performance will require larger scale devices. Overall, the gathered data is extremely valuable from the standpoint of understanding plasma behavior and for developing empirical scaling laws.
Author
*Magnetohydrodynamics; Pulse Detonation Engines; Propulsion System Configurations; Convergent-Divergent Nozzles; Performance Tests*

**20020067654** NASA Marshall Space Flight Center, Huntsville, AL USA
**Empty Flux Tubes and Plasmasphere Refilling as Seen by IMAGE**
Adrian, M. L., NASA Marshall Space Flight Center, USA; Gallagher, D. L., NASA Marshall Space Flight Center, USA; Sandel, B. R., NASA Marshall Space Flight Center, USA; Green, J. L., NASA Marshall Space Flight Center, USA; Reinish, B., NASA

Marshall Space Flight Center, USA; Goldstein, J., NASA Marshall Space Flight Center, USA; Huegrich, T., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; American Geophysical Union Spring Meeting, 28-31 May 2002, Washington, DC, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity; Abstract Only

When a plasmaspheric flux tube is empty, what plasma is actually missing? When a flux tube refills, where does the plasma accumulate first? How long does it take to refill a flux tube to a level that is essentially saturated? Owing to the observational difficulties of measuring the distribution of plasmaspheric plasma along a flux tube, these questions have remained unanswered over many decades of study since discovery of the plasmasphere. They are important questions, because of the role that plasmaspheric plasma plays in collisional losses of higher energy populations, in modifying instabilities for wave-particle interactions, and in influencing the transport of energy through plasma waves. The Extreme Ultraviolet Imager and the Radio Plasma Imager on the IMAGE Mission are providing new, critical observations of the dynamic outer plasmasphere where convective erosion and refilling dominate. Latitudinal density profiles along a single L-shell from BPI confirm earlier indications of a mid-latitude transition between the altitude organized structure of the ionosphere and L-shell organized plasmasphere. Emptied flux tubes often mean empty only above about 1 Re in altitude or below plus or minus 40 degrees in magnetic latitude. Refilling to nearly saturated levels is found to take much less than that previously found necessary to complete the process. The observations behind these conclusions and the new light brought to plasmaspheric refilling will be discussed.

Author

*Plasma Waves; Plasmasphere; Image Satellite; Magnetic Flux*

## 76
## SOLID-STATE PHYSICS

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

**20020065289** Front Edge Technology, Inc., Baldwin Park, CA USA

**Development of Novel Boron-based Multilayer Thin-Film** ***Annual Report, 15 Dec. 1998 - 15 Jun. 1999***

Nieh, S.; 1999; 16p; In English

Report No.(s): DE2002-762805; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In the past six months, this project was focused on more fundamental studies of the coating properties. The properties of each individual coating TiBz, TiBC as well as the alternating TiBz/TiBC laminates were studied. These properties include residual stress, surface morphology and topography, adhesion and wear rate. The coatings were deposited using dc magnetron reactive sputtering process. Deposition of the films was carried out in a production-scale, three-chamber-in-line coating system, consisting of a load-lock chamber, and two deposition chambers. The substrates were cleaned and mounted on a rack before going into the chamber. A computerized conveyor system transported the rack into the load-lock chamber, where the pressure was pumped down to around 2E-5 torr. The substrates were then preheated by an infrared heater to about 10O C.

NTIS

*Coatings; Thin Films; Product Development; Boron; Surface Properties*

**20020065547** Oak Ridge National Lab., TN USA

**Analysis of Neutron Scattering Data: Visualization and Parameter Estimation**

Beauchamp, J. J.; Fedorov, V.; Hamilton, W. A.; Yethiraj, M.; Sep. 1998; 40p; In English

Report No.(s): DE2002-771196; ORNL-13677; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Traditionally, small-angle neutron and x-ray scattering (SANS and SAXS) data analysis requires measurements of the signal and corrections due to the empty sample container, detector efficiency and time-dependent background. These corrections are then made on a pixel-by-pixel basis and estimates of relevant parameters (e.g., the radius of giration) are made using the corrected data. This study was carried out in order to determine whether treatment of the detector efficiency and empty sample cell in a more statistically sound way would significantly reduce the uncertainties in the parameter estimators. Elements of experiment design are shortly discussed in this paper. For instance, we studied the way the time for a measurement should be optimally divided between the counting for signal, background and detector efficiency.

NTIS

*Neutron Scattering; Scientific Visualization; X Ray Scattering; Data Processing*

**20020065549** Argonne National Lab., IL USA

**Polycapillary Optics Based Neutron Focusing for Small Sample Neutron Crystallography**

Gibson, W. M.; Chen-Mayer, D. F.; Prask, H. J.; Schultz, A. J.; Youngman, R.; 2002; 12p; In English

Report No.(s): DE2002-793054; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This work presents preliminary measurements designed to explore a new approach to neutron diffraction that is somewhat analogous to the pseudo-Laue technique, except that instead of using a broad energy (wavelength) bandwidth it uses a broad angular bandwidth. We have used a polycapillary focusing optic to focus neutrons from a monochromatic beam (using the BT-8 spectrometer on the NIST research reactor) and from a polychromatic beam at a pulsed spallation source (the Intense Pulsed Neutron Source, IPNS at Argonne National Laboratory) into a small, intense spot and have carried out preliminary diffraction measurements. Using the single crystal diffraction (SCD) facility on IPNS, diffraction of a 3 degrees convergent beam from an alpha quartz crystal showed six diffraction beams in the 1-5 A wavelength bandwidth transmitted by the optic. The diffraction spots showed an intensity gain of 5.8 plus or minus 0.9 compared to a direct beam diffracting from the same sample volume as that illuminated by the convergent beam.

NTIS

*Crystallography; Neutron Sources; Neutrons; Crystal Optics; Diffraction*

**20020066323** Columbia Univ., Dept. of Mechanical Engineering, New York, NY USA

**MEMS and Nanotechnology in the 21st Century**

Frechette, Luc G., Columbia Univ., USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 125-148; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

The topics include: 1) Natural Trend Towards Smaller Scales; 2) MicroElectroMechanical Systems and Nanotechnology; and 3) Implications on Education, Industry, and Research. This paper is in viewgraph form.

CASI

*Microelectromechanical Systems; Nanotechnology; Fabrication; Molecular Electronics*

**20020066330** Maryland Univ., Dept. of Materials Science and Engineering Science, College Park, MD USA

**Low-Budget Epitaxy: Copper on Silicon**

Kidder, John N., Jr., Maryland Univ., USA; Martinez-Miranda, Luz, Maryland Univ., USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 257-263; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

The objective is to introduce students to the principles of thin film growth, generation of an atomic flux, deposition rate, surface cleaning in silicon processing, surface structure and chemistry, interface energy and epitaxy, and metallization in semiconductor technology.

Derived from text

*Copper; Epitaxy; Metallizing; Semiconductors (Materials); Silicon*

**20020066471** NASA Marshall Space Flight Center, Huntsville, AL USA

**Crystal Growth of ZnSe and Related Ternary Compound Semiconductors by Vapor Transport**

Su, Ching-Hua, NASA Marshall Space Flight Center, USA; Brebrick, R. F., Marquette Univ., USA; Dudley, M., State Univ. of New York, USA; Ramachandran, N., Universities Space Research Association, USA; [2002]; 1p; In English; 2002 NASA Materials Science Conference, 25-26 Jun. 2002, Huntsville, AL, USA; Sponsored by NASA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The objective of the project is to determine the relative contributions of gravity-driven fluid flows to the compositional distribution, incorporation of impurities and defects, and deviation from stoichiometry observed in the crystals grown by vapor transport as results of buoyance-driven convection and growth interface fluctuations caused by irregular fluid-flows. ZnSe and related ternary compounds, such as ZnSeS and ZnSeTe, were grown by vapor transport technique with real time in-situ non-invasive monitoring techniques. The grown crystals were characterized extensively to correlate the grown crystal properties with the growth conditions. The following are the research progress in the past two years. In-situ monitoring of partial pressure by optical absorption technique and visual observation of the growing crystal were performed during vapor growth of ZnSe. Low-temperature photoluminescence (PL) spectra and glow discharge mass spectroscopy (GDMS) were measured on ZnSe starting materials provided by various vendors and on bulk crystals grown from these starting materials by physical vapor transport (PVT) to study the effects of purification and contamination during crystal growth process. Optical characterization was performed on wafers sliced from the grown crystals of ZnSe, ZnTe and ZnSe(1-x),Te(x), (0<xislessthan0.4).Energyban gaps at

room temperature were determined from optical transmission measurements and a best fit curve to the band gap vs. composition, x, data gives a bowing parameter of 1.45. Low-temperature photoluminescence (PL) spectra of ZnSe and ZnTe were dominated by near band edge emissions and no deep donor-acceptor pairs were observed. The PL spectrum exhibited a broad emission for the ZnSe(1-x),Te(x), samples, 0.09<xislessthan0.39.Thesingleroad PL emission spectra and the spectra measured as a function of temperature were interpreted as being associated with the exciton bound to Te clusters because of the high Te content in these samples. To validate numerical codes, in-situ monitoring during the PVT of HgI2 was designed. Optical absorption spectra of the vapor phase over HgI2 were measured for wavelengths between 200 and 600nm at sample temperatures between 349 and 610K. The Beer's Law constants for 15 wavelengths between 200 and 440 nm were determined. From these constants the vapor pressure of HgI2 was established as a function of temperature for the liquid and the solid Beta-phases to characterize the growth conditions during the PVT growth of In-doped ZnSe the optical absorbance of the vapor phase over the In-Se system were measured and were used to obtain the partial pressures of Se2(g) and In2Se(g).
Author
*Crystal Growth; Semiconductors (Materials); Vapor Deposition; Vapor Phases; Zinc Tellurides*

**20020066525** Universities Space Research Association, Huntsville, AL USA
**The Effect of the Wall Contact and Post-Growth Cool-Down on Defects in CdTe Crystals Grown by 'Contactless' Physical Vapour Transport**
Palosz, W., Universities Space Research Association, USA; Grasza, K., Polish Academy of Sciences, Poland; Durose, K., Durham Univ., UK; Halliday, D. P., Durham Univ., UK; Boyall, N. M., Durham Univ., UK; Dudley, M., State Univ. of New York, USA; Raghothamachar, B., State Univ. of New York, USA; Cai, L., State Univ. of New York, USA; [2002]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

A series of cadmium telluride crystals grown by physical vapor transport without contact with the ampoule walls and cooled at different rates were characterized using synchrotron X-ray topography, photoluminescence, and chemical etching. Strain from sticking to silica glass and its effect on the dislocation density is shown. It was found that very fast cool-down increases dislocation density by at least one order of magnitude. None of the samples had random dislocation distributions but coarse clumping of dislocations on the scale of more than 100 microns was more prevalent in slowly cooled crystals. Photoluminescence revealed that slow cooling favored the donor-acceptor luminescence involving complex A centers. This was diminished in fast cooled material; and effect presumed to be due to dislocation gettering. Fast cooling also enhanced the formation of shallow acceptors. Implications for Bridgman growth of CdTe and the vapor growth of CdZnTe are discussed briefly.
Author
*Cadmium Tellurides; Crystal Growth; Vapor Deposition; Crystal Defects; Cooling*

**20020066643** NASA Marshall Space Flight Center, Huntsville, AL USA
**Transient Torque Technique for Viscosity and Electrical Conductivity Determination of Semiconducting Liquids**
Li, C., Alabama Univ., USA; Scripa, R. N., Alabama Univ., USA; Ban, H., Alabama Univ., USA; Lin, B., Alabama Univ., USA; Su, C.-H., NASA Marshall Space Flight Center, USA; Lehoczky, S. L., NASA Marshall Space Flight Center, USA; Feth, S., NASA Marshall Space Flight Center, USA; Zhu, S., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 10th International Ceramics Congress on Modern Materials and Technologies, 14-18 Jul. 2002, Florence, Italy; No Copyright; Avail: Issuing Activity; Abstract Only

A novel apparatus based on transient torque technique is constructed in MSFC/NASA. The apparatus uses a 125um diameter quartz fiber as torsion wire. A high sensitive angular detector is implemented to measure the deflection angle of the crucible containing the liquid. A rotating magnetic field (RMF) is used to induce a rotating flow of a conducting or semiconducting melts. by measuring the magnitude and transient behavior of the induced deflection angle, the electrical conductivity and viscosity of the melt can be measured simultaneously. High purity elements namely Hg, Ga, Zn and Te are tested at room temperature and high temperature up to 900 C.
Author
*Electrical Resistivity; Liquids; Torque; Viscosity; Heavy Metals; Surges; Semiconductors (Materials)*

**20020066654** NASA Marshall Space Flight Center, Huntsville, AL USA
**Carbon Nanotubes Growth on Graphite Fibers**
Zhu, Shen, Universities Space Research Association, USA; Su, Ching-Hua, NASA Marshall Space Flight Center, USA; Lehoczky, S. L., NASA Marshall Space Flight Center, USA; Muntele, I., Alabama Agricultural and Mechanical Univ., USA; Ila, D., Alabama Agricultural and Mechanical Univ., USA; [2002]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Carbon nanotubes (CNT) were synthesized on graphite fibers by thermal Chemical Vapor Deposition (CVD). On the fiber surface, iron nanoparticles are coated and act as catalysts for CNT growth. The growth temperature ranges from 550 to 1000 C at an ambient pressure. Methane and hydrogen gases with methane contents of 10% to 100% are used for the CNT synthesis. At high growth temperatures (greater than 800 C), the rapid inter-diffusion of the transition metal iron on the graphite surface results in a rough fiber surface with no CNT grown on the surface. When the growth temperature is relatively low (650 - 800 C), CNT are fabricated on the graphite surface with catalytic particles on the nanotube top ends. Using micro Raman spectroscopy in the breath mode region, single-walled or multi-walled CNT can be determined, depending on methane concentrations.
Author
*Carbon Nanotubes; Graphite; Nanoparticles; Fabrication; Nanostructure Growth; Fiber Composites*

**20020066656** NASA Marshall Space Flight Center, Huntsville, AL USA
**Analysis of Short and Long Range Atomic Order in Nanocrystalline Diamonds with Application of Powder Diffractometry**
Palosz, B., Polish Academy of Sciences, Poland; Grzanka, E., Polish Academy of Sciences, Poland; Stelmakh, S., Polish Academy of Sciences, Poland; Pielaszek, R., Polish Academy of Sciences, Poland; Bismayer, U., Hamburg Univ., Germany; Neuefiend, J., Deutsches Elektronen-Synchrotron, Germany; Weber, H.-P., European Synchrotron Radiation Facility, France; Proffen, T., Los Alamos National Lab., USA; VonDreele, R., Los Alamos National Lab., USA; Palosz, W., Universities Space Research Association, USA; [2002]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Fundamental limitations, with respect to nanocrystalline materials, of the traditional elaboration of powder diffraction data like the Rietveld method are discussed. A tentative method of the analysis of powder diffraction patterns of nanocrystals is introduced which is based on the examination of the variation of lattice parameters calculated from individual Bragg lines (named the ”apparent lattice parameter”, alp). We examine the application of our methodology using theoretical diffraction patterns computed for models of nanocrystals with a perfect crystal lattice and for grains with a two-phase, core-shell structure. We use the method for the analysis of X-ray and neutron experimental diffraction data of nanocrystalline diamond powders of 4, 6 and 12 nm in diameter. The effects of an internal pressure and strain at the grain surface is discussed. This is based on the dependence of the alp values oil the diffraction vector Q and on the PDF analysis. It is shown, that the experimental results support well the concept of the two-phase structure of nanocrystalline diamond.
Author
*Diamonds; Diffraction Patterns; Nanocrystals; Powder (Particles); Diffractometers*

**20020066753** Argonne National Lab., Materials Science Div., IL USA
**Determination and Correction of the Linear Lattice of the APS Storage Ring**
Rehn, L. E.; Baldo, P. M.; Meng, W. J.; Zhang, X. D.; Shi, B.; Mar. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): DE2002-42660; No Copyright; Avail: National Technical Information Service (NTIS)

We have synthesized a series of Ti-Si-N coatings with 0 to 20 at. % Si by high density plasma assisted vapor phase deposition. Composition, structure, and atomic short range order were characterized by Rutherford Backscattering Spectrometry (RBS), Transmission Electron Microscopy (TEM), X-ray Diffraction (XRD), and X-ray Absorption Near Edge Structure (XANES) spectroscopy. The mechanical properties of these coatings were characterized by instrumented nanoindentation, and compared to those of B1-TiN. Our experiments show that the present series of Ti-Si-N coatings are nanocomposites, consisting of a nm-scale mixture of crystalline titanium nitride (TiN) and amorphous silicon nitride (a-Si:N). The mechanical response of the present series of Ti-Si-N coatings was found to be essentially independent of the Si composition, and similar to that of B1-TiN.
NTIS
*Coatings; Titanium Nitrides; Silicon Nitrides; Storage Rings (Particle Accelerators)*

**20020066764** MRJ Technology Solutions, Inc., Moffett Field, CA USA
**Substrate Effects for Atomic Chain Electronics**
Yamada, Toshishige, MRJ Technology Solutions, Inc., USA; [1998]; 26p; In English; 45th American Vacuum Society Meeting, 2-6 Nov. 1998, Baltimore, MD, USA; Sponsored by American Vacuum Society, USA
Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-12; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A substrate for future atomic chain electronics, where adatoms are placed at designated positions and form atomically precise device components, is studied theoretically. The substrate has to serve as a two-dimensional template for adatom mounting with a reasonable confinement barrier and also provide electronic isolation, preventing unwanted coupling between independent adatom structures. For excellent structural stability, we demand chemical bonding between the adatoms and substrate atoms, but

then good electronic isolation may not be guaranteed. Conditions are clarified for good isolation. Because of the chemical bonding, fundamental adatom properties are strongly influenced: a chain with group IV adatoms having two chemical bonds, or a chain with group III adatoms having one chemical bond is semiconducting. Charge transfer from or to the substrate atoms brings about unintentional doping, and the electronic properties have to be considered for the entire combination of the adatom and substrate systems even if the adatom modes are well localized at the surface.
Author
*Substrates; Electrical Properties; Nanostructure (Characteristics); Nanostructures (Devices); Molecular Electronics; Molecular Chains; Microminiaturized Electronic Devices; Atoms*

**20020067452** NASA Marshall Space Flight Center, Huntsville, AL USA
**Photoluminescence of CdTe Crystals Grown by Contactless PVT Method**
Palosz, W., Universities Space Research Association, USA; Grasza, K., Polish Academy of Sciences, Poland; Cui, Y., Fisk Univ., USA; Wright, G., Fisk Univ., USA; Roy, U. N., Fisk Univ., USA; Burger, A., Fisk Univ., USA; [2002]; 1p; In English; SPIE 47th Annual Meeting, 7-11 Jul. 2002, Seattle, WA, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

High quality CdTe crystals with resistivities higher than 10(exp 8) Omega cm were grown by the 'contactless' PVT (physical vapor transport) technique. Group III elements In and Al, and the transition metal Sc were introduced at the nominal level of about 6 ppm to the source material. Low-temperature photoluminescence (PL) has been employed to identify the origins of PL emissions of the crystals. It was found that the emission peaks at 1.584 eV and 1.581 eV exist only in the In-doped crystal. The result suggests that the luminescence line at 1.584 eV is associated with Cd-vacancy/indium complex. The intensity of the broadband centered at 1.43 eV decreases dramatically with introduction of Sc.
Author
*Cadmium Tellurides; Crystal Growth; Photoluminescence*

**20020067455** NASA Marshall Space Flight Center, Huntsville, AL USA
**Characterizing Thermal Properties of Melting Te Semiconductor: Thermal Diffusivity Measurements and Simulation**
Zhu, Shen, Universities Space Research Association, USA; Li, C., Alabama Univ., USA; Su, Ching-Hua, NASA Marshall Space Flight Center, USA; Lin, B., Alabama Univ., USA; Ben, H., Alabama Univ., USA; Scripa, R. N., Alabama Univ., USA; Lehoczky, S. L., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English
Contract(s)/Grant(s): NCC8-66; No Copyright; Avail: Issuing Activity; Abstract Only

Tellurium is an element for many II-VI and I-III-VI(sub 2) compounds that are useful materials for fabricating many devices. In the melt growth techniques, the thermal properties of the molten phase are important parameter for controlling growth process to improve semiconducting crystal quality. In this study, thermal diffusivity of molten tellurium has been measured by a laser flash method in the temperature range from 500 C to 900 C. A pulsed laser with 1064 nm wavelength is focused on one side of the measured sample. The thermal diffusivity can be estimated from the temperature transient at the other side of the sample. A numerical simulation based on the thermal transport process has been also performed. by numerically fitting the experimental results, both the thermal conductivity and heat capacity can be derived. A relaxation phenomenon, which shows a slow drift of the measured thermal conductivity toward the equilibrium value after cooling of the sample, was observed for the first time. The error analysis and the comparison of the results to published data measured by other techniques will be discussed.
Author
*Crystal Growth; Tellurium; Thermal Diffusivity; Semiconductors (Materials); Melting*

## 80
## SOCIAL AND INFORMATION SCIENCES (GENERAL)

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

**20020066324** Loyola Coll., Dept. of Electrical Engineering and Engineering Science, Baltimore, MD USA
**Fishing Line Knot Tying Contest: A Freshmen Experience**
Elban, Wayne L., Loyola Coll., USA; Frantz, Douglas L., Community Coll. of Baltimore County, USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 149-170; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

A procedure is described for conducting a knot tying contest for freshmen engineering/physics students using commercial 6 (and 4) lb-test nylon monofilament fishing lines. A bench-top universal testing machine is used to obtain room temperature

determinations of tensile breaking load for knots tied to a swivel or hook. Emphasis is given to exposing students to materials testing methodology, modifying a standard test fixture configuration to accommodate the knotted samples, and (optional activity) using elementary statistical analysis to assess knot quality. Results from testing samples with a variety of knots, including double overhand, modified double overhand, Palomar, Improved Clinch, Perfection, and Harvey are presented. Experimental determinations of knot efficiencies are compared to values appearing in the literature.
Author
*Fishing; Tensile Tests; Mechanical Devices; Thermoplasticity; Hooks*

**20020066327** Columbia Univ., New York, NY USA
**Gateway Engineering Coalition**
Friedman, Morton, Columbia Univ., USA; Fromm, Eli, Drexel Univ., USA; National Educators' Workshop: Update 2001 Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 193-216; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

The Gateway Engineering Education Coalition is presented. The topics include: 1) Gateway Coalition Broadly Defined Goals; 2) Gateway Strategies; and 3) The Gateway Web Repository Legacy. This paper is presented in viewgraph form.
CASI
*Concurrent Engineering; Education; Technology Assessment*

**20020066334** Arizona State Univ., Center for Research on Education in Science, Engineering, and Technology, Tempe, AZ USA
**The MAGSET K-12 Curriculum Project**
Evans, Don L., Arizona State Univ., USA; National Educators' Workshop: Update 2001: Standard Experiments in Engineering, Materials Science, and Technology; June 2002, pp. 309-324; In English; Also announced as 20020066311; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

The Materials As the Gateway (and Glue) for Science, Engineering and Technology (MAGSET) goal is to utilize materials as diverse as metals, plastics, semiconductors, ceramics "geomaterials" and biomaterials, as the gateway and the glue in which science, mathematics, engineering and technology (SMET) learning can be effective for the general population.
Derived from text
*Technology Utilization; Composite Materials; Education*

**20020066508** National Agricultural Library, Rural Information Center, Beltsville, MD USA
**Innovative Approaches in Rural Education**
Tuthill, S. J.; Aug. 2000; 46p; In English
Report No.(s): PB2002-107882; RICPS-72; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Rural areas of the USA are uniquely characterized yet each one is affected in some measure by our country's continued economic and demographic restructuring. As telecommunications advance at a rapid pace, our rural public school systems must take advantage of new and exciting teaching methodologies and tools which are used as supplements to teacher supply, fostering motivation, and curriculum development. Several of these current techniques include distance learning, experiential education, and computer networking. These 'links' with outside resources hold the key to a student's academic success and future livelihood. Rural areas must be kept well informed as technological innovations continue to evolve. It is the intent of this publication to provide access to the current literature discussing innovations in teaching methods so that teachers and parents can increase student success. This resource was designed to reach those who work with minorities, youth-at-risk, gifted, and emotionally and physically handicapped. Other important information in this resource focuses on giving rural students the same opportunities as urban students, and provide a broader scope of resources to increase teaching effectiveness. The format of this publication is broken down into user-friendly divisions such as funding assistance, curriculum design, technological advances, periodicals, multimedia, books, articles, and cooperative teaching.
NTIS
*Education; Rural Areas; Technologies; Telecommunication*

## 81
## ADMINISTRATION AND MANAGEMENT

*Includes management planning and research.*

**20020065268** Institute for Human Factors TNO, Soesterberg, Netherlands
**Training in Maritime Tactical Command *Final Report Training in Beeld- en Besluitvorming***
Helsdingen, A. S., Institute for Human Factors TNO, Netherlands; vandenBosch, K., Institute for Human Factors TNO, Netherlands; deBeer, M. M., Institute for Human Factors TNO, Netherlands; May 02, 2002; 98p; In Dutch
Contract(s)/Grant(s): 013.20344.01.03; TNO Proj. 790.3
Report No.(s): TD-2001-0378; TNO-TM-02-A021; Copyright; Avail: Issuing Activity

Tactical missions often take place under difficult circumstances that are characterized by complexity and uncertainty. In the preparation, execution and monitoring of tactical plans it is often not possible to collect sufficient information that is unambiguous and reliable. Nevertheless it is expected that commanders and command teams make correct and timely situation assessments and decisions. Thus, great demands are placed on staff officers and command teams, and there is an increasing demand for efficient and effective methods for instruction and training in tactical command. One of the new programs for training in tactical command that were restaged under the influence of recent developments in decision making is training in critical thinking. Results of previous exploratory studies on this training approach are promising. However, for a successful application of training in critical thinking there is a need for more knowledge on the effects of this approach for training of teams in a complex, interactive training environment that resembles real life operations. The study into the effects of critical thinking training was carried out at the Operational School (BPS) of the Royal Netherlands Navy. Our participants were anti air-, surface- or underwater warfare instructors of the Tactical Education Department, grouped according to expertise in either air defence (AAW) or (sub)surface defence (ASW/ASuW) teams. Half of the participating (AAW) and ASW/ASuW teams received support feedback according to the principles of critical thinking; the other teams did not receive specific directions and practiced the scenarios as usual. Teams were offered the same scenarios. The first part of training consisted of role-play scenarios guided by instructors. After these role-play scenarios, teams practiced AAW or ASW/ASuW scenarios in the tactical simulator. After training, the performance of the teams was assessed on two test scenarios in the tactical simulator. Critical thinking training produced positive effects on the process of command (better argumentation for situation assessment and better time management) as well as on the outcomes (more and better contingency plans, and better team functioning). Critical thinking method seems perfectly suitable for use in a team. Furthermore a simple training environment sometimes turns out to be more suitable for critical thinking than a lifelike one.
Author
*Air Defense; Decision Making; Education; Tactics*

**20020065359** Ballistic Missile Defense Organization, Washington, DC USA
**Ballistic Missile Defense Organization: 2001 Technology Applications Report**
2002; 44p; In English
Report No.(s): PB2002-107857; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Ballistic Missile Defense Organization (BMDO) invests in new innovative technologies to help defend the USA, its allies, and its friends from increasingly sophisticated ballistic missile threats. From its inception, BMDO and its predecessor, the Strategic Defense Initiative Organization (SDIO), have supported the development of these technologies for direct integration into weapon systems as well as for spinoffs into commercial applications. The commercial market oftentimes provides the right environment to mature leading-edge technologies that may be too risky or unproven for missile defense. The 2001 Technology Applications Report features BMDO investments that have met commercial success, are being used in military systems, or both. Highlighted technologies are grouped into four sections: computing and communications, materials, sensors and tracking, and energy and propulsion.
NTIS
*Antimissile Defense; Defense Program; Technology Utilization; Technology Assessment; Ballistic Missiles*

**20020066286** Ballistic Missile Defense Organization, Washington, DC USA
**Ballistic Missile Defense Organization: 1998 Technology Applications Report**
2002; In English; This document is color dependent and/or in Landscape layout. It is currently only available on CD-ROM
Report No.(s): PB2002-107856; No Copyright; Avail: National Technical Information Service (NTIS)

Contents include the following: Introduction (BMDO's Mission, BMDO's Technology Applications Program); Communications and Networking Technologies (Wireless, Like You Never Heard It Before, The Wireless Future Is-Guinea, Laser Aims to Shoot Data Through the Air, Optical Switch Pushes the Data Envelope); Energy Technologies (Zapped. Capacitors

Charge Against Microbes, Tapping the Sun in the Next Millennium, Liquid Additive Is Cool for Air Conditioners, Ultrafast Switch Energizes Diverse Markets); Health and Medical Technologies (Microwaves Zero In on Breast Tumors, Implants Mean More Support for Weakened Spines, Optical Biopsy Shines New Light on Cancer, A New Day Dawns for Revitalized Laser); Manufacturing Technologies (Wafer Maker Pushes the Speed Limit, Tunable Filter Solves Process Problems, New Machine Shapes Up Wafers Better, High-Energy Laser Blasts Metals); Materials Technologies (Silicon Carbide Is Ready for Prime Time, Carbon Aerogel Really Cleans Up Water, Alloys Make Losing Weight Easy, Oil Additive Keeps Engines Healthy); Optical and Sensor Technologies (Adaptive Optics See Bright Future in Shipping, Movie Production, Correlator Helps Put a Finger on Crime, Production Problems, Shocking News: It's a Bump Buster, This Device Is Nice for Detecting Ice); Tech Trivia Answers; Index of Subjects.
NTIS
*Adaptive Optics; Air Conditioning Equipment; Energy Technology; Implantation; Mammary Glands; Technology Utilization*

**20020066428** NVI, Inc., Greenbelt, MD USA
**Support of the Laboratory for Terrestrial Physics for Dynamics of the Solid Earth (DOSE)** ***Final Report, 8 Jan. 1993 - 31 Jan. 2001***
Vandenberg, Nancy R., NVI, Inc., USA; June 2001; 8p; In English
Contract(s)/Grant(s): NAS5-32331; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
This final report summarizes the accomplishments during the contract period. Under the contract NVI, Inc. provided support to the VLBI group at NASA's Goddard Space Flight Center. The contract covered a period of approximately eight years during which geodetic and astrometric VLBI evolved through several major changes. This report is divided into four sections which correspond to major task areas in the contract: A) Coordination and Scheduling, B) Field System, C) Station Support, and D) Analysis and Research and Development.
Author
*Very Long Base Interferometry; Coordination; Scheduling; Management Planning*

**20020066458** Reality Capture Technologies, Inc., San Jose, CA USA
**Visualizing Progress**
Spinoff 2000; 2000, pp. 70; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.
Reality Capture Technologies, Inc. is a spinoff company from Ames Research Center. Offering e-business solutions for optimizing management, design and production processes, RCT uses visual collaboration environments (VCEs) such as those used to prepare the Mars Pathfinder mission.The product, 4-D Reality Framework, allows multiple users from different locations to manage and share data. The insurance industry is one targeted commercial application for this technology.
Author
*Technology Utilization; Information Flow; Data Acquisition; Applications Programs (Computers); Information Transfer; Data Transfer (Computers)*

**20020066530** Minority Business Development Agency, Washington, DC USA
**Minority Businesses' Use of Internet Technology: A Preliminary Case Study of Large Firms**
2002; 48p; In English
Report No.(s): PB2002-107875; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Contents include the following: Executive summary; Introduction and Purpose; Scope and Methodology: Sampling Design; Analytical Procedures, and Measuring Electronic Commerce; Survey Results: Profile of Business Executives Interviewed; Business Characteristics; Use of Information Technology; Respondents' Perceptions of Benefits, Use and Expectations about E-commerce; Web Presence and E-commerce Participation; Capability of Existing Websites; Brick-and-Mortar or Virtual Firms; Economic Sector Served; Products and Services Sold Online; Barriers to E-commerce Participation; and Lessons Learned; Factors Affecting the Use of Internet Technology: Results for the Website Availability Equation; and Results for the E-commerce Participation Equations; Conclusions and Implications; Recommendations, and Bibliography.
NTIS
*Internets; Computer Networks; Minorities; On-Line Systems; Economics*

**20020066557** Physics and Electronics Lab. TNO, The Hague, Netherlands
**Naval Land Attack Missile Systems: 2001 Survey Based on Unclassified Sources** ***Final Report***
vanderWiel, W. M., Physics and Electronics Lab. TNO, Netherlands; Banning, R., Physics and Electronics Lab. TNO,

Netherlands; June 2002; 36p; In English; Original contains color illustrations
Contract(s)/Grant(s): V026; TNO Proj. 015.30709
Report No.(s): TD-01-0278; FEL-01-A320; Copyright; Avail: Issuing Activity

In modern conflicts western nations are more and more confronted with operations in remote areas. Naval operations play an important role in these conflicts. One part of this role is the ability of on shore power projection in the form of land attack operations or naval fire support. The Royal Netherlands Navy is developing knowledge about the capability to conduct complex naval fire support operations. In support of the Royal Netherlands Navy, this document gives a qualitative analysis of modern land attack missile systems. The description of land attack missiles given in this report is based on open literature sources and sources from the Internet. Although the information derived from these sources can not be guaranteed to always be accurate, the use of inaccurate information is minimized through a process of cross confirmation, possibly against data obtained directly from the manufacturer.

Author

*Missile Systems; Surface to Surface Missiles; Armed Forces (Foreign); Military Operations; Ships*

**20020066563** Defence Science and Technology Organisation, Information Technology Div., Edinburgh Australia

**C4ISR Architectures, Social Network Analysis and the FINC Methodology: An Experiment in Military Organizational Structure**

Dekker, Anthony H., Defence Science and Technology Organisation, Australia; January 2002; 42p; In English; Original contains color illustrations
Report No.(s): DSTO-GD-0313; DODA-AR-012-129; Copyright; Avail: Issuing Activity

In this paper we present a simple testbed for experimenting with C4ISR architectures (based on a ”SCUD hunt” scenario), the FINC methodology for analysing C41SR architectures, and some experimental results. The testbed allows us to explore different organizational architectures under a range of conditions. The FINC (Force, Intelligence, Networking and C2) methodology allows the calculation of three metrics for every C41SR architecture. Applying the FINC methodology to our testbed provides a partial validation of the methodology, as well as allowing us to derive four basic principles of C41SR architectures.

Author

*Architecture (Computers); Network Analysis; Test Stands*

**20020066642** NASA Ames Research Center, Moffett Field, CA USA

**Airspace Complexity and its Application in Air Traffic Management**

Sridhar, Banavar, NASA Ames Research Center, USA; Chatterji, Gano, NASA Ames Research Center, USA; Sheth, Kapil, NASA Ames Research Center, USA; [1998]; 4p; In English; Second USA/Europe Air Traffic Management R & D Seminar, 1-4 Dec. 1998, Orlando, FL, USA; Sponsored by Federal Aviation Administration, USA
Contract(s)/Grant(s): RTOP 538-18-25; No Copyright; Avail: Issuing Activity; Abstract Only

The USA Air Traffic Management (ATM) system provides services to enable safe, orderly and efficient aircraft operations within the airspace over the continental USA and over large portions of the Pacific and Atlantic Oceans, and the Gulf of Mexico. It consists of two components, Air Traffic Control (ATC) and Traffic Flow Management (TFM). The ATC function ensures that the aircraft within the airspace are separated at all times while the TFM function organizes the aircraft into a flow pattern to ensure their safe and efficient movement. In order to accomplish the ATC and TFM functions, the airspace over USA is organized into 22 Air Route Traffic Control Centers (ARTCCs). The Center airspace is stratified into low-altitude, high-altitude and super-high altitude groups of Sectors. Each vertical layer is further partitioned into several horizontal Sectors. A typical ARTCC airspace is partitioned into 20 to 80 Sectors. These Sectors are the basic control units within the ATM system.

Author

*Air Traffic Control; Flight Operations; Aircraft Approach Spacing; Flight Plans; Flight Management Systems; Airspace*

**20020066777** NVI, Inc., Greenbelt, MD USA

**Support of the Laboratory for Terrestrial Physics for Dynamics of the Solid Earth (DOSE)** ***Final Report, 1 Feb. - 31 Jul. 2001***

Vandenberg, N. R., NVI, Inc., USA; Mar. 05, 2002; 5p; In English
Contract(s)/Grant(s): NAS5-01073; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This final report summarizes the accomplishments during the contract period. Under the contract Nepal, Inc. provided support to the VLBI group at NASA’s Goddard Space Flight Center. The contract covered a period of approximately eight years during high geodetic and astrometric VLBI evolved through several major changes. This report is divided into five sections that

correspond to major task areas in the contract: A) Coordination rid Scheduling, B) Field System, CN Station Support, D) Analysis and Research and Development, and E) Computer Support.
Author
*Very Long Base Interferometry; Scheduling; Coordination; Management Planning; Laboratories*

**20020067449** NASA Marshall Space Flight Center, Huntsville, AL USA
**Advanced Mirror System Demonstrator (AMSD) Risk Management**
Byberg, Alicia, Pace and Waite, Inc., USA; Russell, J. Kevin, NASA Marshall Space Flight Center, USA; Kaukler, Donna, NASA Marshall Space Flight Center, USA; Aug. 17, 2002; 1p; In English; Fourth National Symposium on Space System Risk Management: Key Actions for the 21st Century, 21-24 May 2002, McLean, VA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

This paper will report risk issues associated with designing, manufacturing, and testing the Advanced Mirror System Demonstrator (AMSD). The Advanced Mirror System Demonstrator (AMSD) will be developed as a lightweight primary mirror system that can be produced at a low cost and with a short manufacturing schedule. This technology will add to the knowledge base for selection for the Next Generation Space Telescope (NGST), Space Based Laser (SBL), Research Laboratory mission (AFRL), and other government agency programs.
Author
*Risk; Mirrors; Spaceborne Telescopes; Proving*

**20020067632** NASA Marshall Space Flight Center, Huntsville, AL USA
**Managing Risk on a Technology Development Project/Advanced Mirror System Demonstrator**
Byberg, Alicia, Science Applications International Corp., USA; Russell, J. Kevin, NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; Fourth National Symposium on Space System Risk Management, 21-24 May 2002, McLean, VA, USA Contract(s)/Grant(s): NASA Order H-34878-D; No Copyright; Avail: Issuing Activity; Abstract Only

The risk management study applied to the Advanced Mirror System Demonstrator (AMSD), a precursor mirror technology development for the Next Generation Space Telescope (NGST) is documented. The AMSD will be developed as a segment of a lightweight primary mirror system that can be produced at a low cost and with a short manufacturing schedule. The technology gained from the program will support the risk mitigation strategy for the NGST, as well as other government agency space mirror programs.
Author
*Risk; Evaluation; Spaceborne Telescopes; Mirrors*

## 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.*

**20020065254** Army War Coll., Carlisle Barracks, PA USA
**TERRORISM: A Selected Bibliography**
Bey, Jacqueline S.; Dec. 2001; 45p; In English
Report No.(s): AD-A403338; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
No Abstract
DTIC
*Bibliographies; Terrorism*

**20020065271** Colorado Univ., Boulder, CO USA
**Global Media and Public Affairs Communications in a New Era of Defense: The War Against Terrorism**
Tasista, Michele M.; Apr. 02, 2002; 176p; In English
Report No.(s): AD-A403296; CI02-90; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

The Sept. 11, 2001, terrorist attacks and subsequent conflict in Afghanistan culminated a 30-year escalation of terrorism and efforts to counter it, an undeclared war that has unfolded principally on the information battlefield. Though terrorists habitually denounce the elements of modernity and globalization, they manipulate the transnational media to commit and communicate their violence and virulent rhetoric. This qualitative study considers the information battle field in the war against terrorism and how

the U.S. emergence as the primary economic, political and media superpower ensured its position as a terrorists' target during the late 20th Century. This also notes that the exponential growth of the U.S. news media market paralleled the increasing brutality of terrorism directed against U.S. interests. As a result, leaders past and present have sought to engage the U.S. information dimension of national power to communicate American policies and capabilities, though in recent months that effort has been mostly directed toward the "Arab Street" of public opinion.
DTIC
*Terrorism; Marketing; Violence; Policies*

**20020065286** Army Training and Doctrine Command, Dismounted Battlespace Battle Lab., Fort Monroe, VA USA
**Information Management: Records Management: List of Approved Recurring Reports**
Jan. 11, 2000; 25p; In English
Report No.(s): AD-A403598; TRADOC-PAM-25-53; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This pamphlet contains an updated listing of controlled recurring reports. Pamphlet will be maintained electronically on the TRADOC (Army Training and Doctrine Command) Homepage and updated as changes occur. Deputy Chiefs of Staff and Special Staff Offices are responsible for ensuring the proponent of this pamphlet is notified when a new recurring requirement is received from higher headquarters or one is imposed by HQ TRADOC on a subordinate activity.
DTIC
*Information Systems; Data Management*

**20020065292** General Accounting Office, Washington, DC USA
**Executive Office of the President: Analysis of Mandated Report on Key Information Technology Areas**
Jul. 28, 2002; 12p; In English
Report No.(s): AD-A403511; GAO-02-779R; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
In the fiscal year 2002 appropriations act covering the Executive Office of the President (EOP), the Congress limited the office's use of systems modernization funds until EOP submitted a report to the House and Senate Committees on Appropriations that included an enterprise architecture (blueprint for modernization), a description of an information technology (IT) capital planning and investment control process, a capital investment plan (portfolio of planned investments for fiscal year 2003), and an IT human capital plan (an approach to meeting strategic human capital needs). As specified in the act, the report was to be approved by the Office of Management and Budget (0MB) and reviewed by us. EOP submitted its enterprise architecture, investment control process description, and capital investment plan on March 13, 2002; the IT human capital plan followed on March 18, 2002. These submissions constitute EOP's report, which 0MB subsequently approved on April 19, 2002. As we agreed with your offices, our review objective was to determine EOP's progress and plans relative to the four areas covered by the report.
DTIC
*Appropriations; Management Planning*

**20020065296** Department of the Army, Washington, DC USA
**Information Management: Army Information Management**
May 31, 2002; 119p; In English
Report No.(s): AD-A403523; AR-25-1; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
This regulation establishes the policies and assigns responsibilities for information management and information technology. It applies to information technology contained in both business systems and national security systems (except as noted) developed for or purchased by the Department of Army. It addresses the management of information as an Army resource, the technology supporting information requirements, and the resources supporting information technology. The regulation implements the Public Law 104-106, Clinger-Cohen Act of 1996 (formerly Division E, Information Technology Management Reform Act, Defense Authorization Act for 1996), and establishes the DISC4 as the Army's Chief Information Officer (CIO). The full scope of CIO responsibilities and management processes is delineated throughout this regulation. These management processes involve strategic planning, business process analysis and improvement, assessment of proposed systems, resource management (to include investment strategy), performance measurements, acquisition, and training.
DTIC
*Management Information Systems; Information Management; Resources Management; User Requirements*

**20020065311** Department of Defense, Office of the Inspector General, Arlington, VA USA
**Information Technology: Acquisition and Clinger-Cohen Act Certification of the Defense Integrated Military Human Resources System**
Jun. 28, 2002; 57p; In English
Report No.(s): AD-A403363; IG/DOD-D-2002-123; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
This report is the third in a series evaluating certifications that DoD automated information systems were being developed in accordance with the Clinger-Cohen Act. During FYs 2000 and 2001, Congress required that the Chief Information Officer of the DoD, before approving acquisition Milestones I, II, or lII of high-cost information systems, evaluate the actions taken related to specific requirements of the Clinger-Cohen Act. to help ensure effective oversight of DoD information technology investments, Congress included Section 8121(b) in the DoD Appropriations Act for FY 2000, which also required the Chief Information Officer of the DoD to inform Congress of the certifications and to provide confirmation that DoD Components took steps to meet specific requirements of the Act.
DTIC
*Information Systems; Human Resources; Automatic Control; Appropriations*

**20020065338** University of Southern California, School of Engineering, Marina del Rey, CA USA
**KCAP K-CAP Conference Support** ***Final Report, 1 Jul.-31 Dec. 2001***
Gil, Yolanda; Mar. 21, 2002; 222p; In English
Contract(s)/Grant(s): F49620-01-1-0437
Report No.(s): AD-A403428; AFRL-SR-AR-TR-02-0165; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche
This report includes the compiled papers from the 1st International Conference on Knowledge Capture held 21-23 Oct 2001 and sponsored by AFOSR. In today's Web-linked and data-rich world, there is a growing need to manage burgeoning amounts of information effectively. Although indexing and linking documents and other information sources is an important step, capturing the knowledge contained within these diverse sources is crucial for the effective use of large information repositories. Knowledge acquisition has been a challenging area of research in artificial intelligence, with its roots in early work to develop expert systems. Driven by the modern Internet culture and by knowledge-based industries, the study of knowledge acquisition has a renewed importance. Although there has been considerable work in the area of knowledge capture, activities have been distributed across several distinct research communities. In machine learning, learning apprentices acquire knowledge by non-intrusively watching a user perform a task. In the human-computer interaction community, programming-by-demonstration systems learn to perform a task by watching a user demonstrate how to accomplish it. In knowledge engineering, modeling techniques and design principles have been proposed for knowledge-based systems, often exploiting commonly occurring domain-independent inference structures and reusable domain-specific ontologies. In planning and process management, mixed-initiative systems acquire knowledge about a user's goals by taking commands or accepting advice regarding a task. In natural language processing, tools can process text and create representations of its knowledge content. All of these approaches are related in that they acquire information and organize it in knowledge structures that can be used for reasoning. They are complementary in that they use different techniques and approaches to capture different forms of knowledge.
DTIC
*Conferences; Expert Systems; Artificial Intelligence; Knowledge Representation*

**20020065374** Department of the Army, Washington, DC USA
**Medical Services: Medical Record Administration and Health Care Documentation**
May 03, 1999; 166p; In English
Report No.(s): AD-A403241; DA-AR-40-66; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche
This regulation prescribes policies for preparing and using medical reports and records in accordance with North Atlantic Treaty Organization standardization agreements (NATO STANAGs) 2348 and 2132 and quadripartite standardization agreement (QSTAG) 470. The purpose of a medical record is to provide a complete medical and dental history for patient care, medicolegal support, research, and education. A medical record also provides a means of communication where necessary to fulfill other Army functions (for example, identification of remains).
DTIC
*Medical Services; Records Management; Regulations; Education; Policies*

**20020065444** Defence Science and Technology Organisation, Information Technology Div., Edgecliff, Australia
**Experimental Comparisons of Data Entry by Automatic Speech Recognition, Keyboard, and Mouse**
Mitchard, Helen, Defence Science and Technology Organisation, Australia; Winkles, Jim, Defence Science and Technology

Organisation, Australia; November 2001; 60p; In English
Report No.(s): DSTO-RR-0220; DODA-AR-012-066; Copyright; Avail: Issuing Activity

The objective was to determine the conditions under which Automatic Speech Recognition (ASR) is an efficient choice for data entry. In particular the focus was on data entry tasks that are part of constructing military messages. The ADF Formatted Messaging System utilises a structured formatting system to constrain the semantics of a message but also includes a field for unlimited and unstructured text. Hence the data entry tasks involved range from form-filling to free dictation of short phrases. In the experiments, ASR and manual input modes are compared for three data entry tasks: textual phrase entry, selection from a list, and numerical data entry. to effect fair comparisons, the tasks minimized the transaction cycle for each input mode and data type and the main comparisons use only times from correct data entry. The results indicate that for inputting short phrases ASR only competes if the typist's speed is below 45wpm. For selecting an item from a list, ASR offered an advantage only if the list length was greater than 15 items. For entering numerical data, ASR offered no advantage over keypad or mouse. The general conclusion for formatted data entry is that a keyboard/mouse interface designed to match the data to be entered will be more time efficient than any equivalent ASR interface.

Author

*Semantics; Speech Recognition; Data Processing; Automatic Control*

**20020065514** Naval Research Lab., Marine Geosciences Div., Stennis Space Center, MS USA

**System Documentation for the Geospatial Information DataBase (GIDBtm) System Server Version 2.0**

McCreedy, Frank; Ladner, Roy; Wilson, Ruth; Breckenridge, John; Carter, Susan; Jun. 24, 2002; 22p; In English
Report No.(s): AD-A403692; NRL/MR/7440-02-8275; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Geospatial Information DataBase (GIDB(Trademark)) offers a fully Object Oriented (OO) database approach to managing the input, storage, retrieval, and presentation of geospatial data in relation to a specific user defined area of interest (AOI). It uses both public domain and commercial OO database management systems (DBMS) technology to store and retrieve the data and can present this information in both 2D and 3D perspective views. It also offers the flexibility to query spatial data with reference to time and space.

DTIC

*Data Bases; Geographic Information Systems*

**20020065520** Air Force Communications Agency, Scott AFB, IL USA

**Air Force Manual 33-214, Volume 2, Communications and Information. Emission Security Countermeasures Reviews**

Sep. 21, 2001; 189p; In English
Report No.(s): AD-A403686; AFM 33-214; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

This Air Force manual (AFMAN) implements Air Force Policy Directive (AFPD) 33-2, Information Protection (will become 'Information Assurance IA'). This AFMAN provides guidance for conducting emission security (EMSEC) countermeasures reviews for information systems, communications systems, and cryptographic equipment according to Air Force Instruction (AFI) 33-203, Emission Security. As part of IA, this AFMAN implements the National Security Telecommunications and Information Systems Security Memorandum (NSTISSM)/TEMPEST 2-95, (FOUO) BED/BLACK Installation Guidance (U). Use this manual in conjunction with Air Force Systems Security Instruction (AFSSI) 7010, (S) Emission Security Assessments (U) (will become AFMAN 33-214, Volume I). Use of extracts is encouraged. Additional security instructions and manuals are listed on the Air Force publications Web site at URL: http://afpubs.hq.af.mil under electronic publications. Air Force Directory (AFDIR) 33-303, Compendium of Communications and Information Terminology, explains other terms. Direct technical questions on the contents of this manual to Headquarters Air Force Communications Agency (HQ AFCA/TCBA-CTTA), 203 W. Losey Street, Room 2000, Scott AFI IL 62225-5222. Send recommended changes or comments to HQ AFCA/ITPP, 203 W. Losey Street, Room 1100, Scott AFI IL 62225-5222, through appropriate channels, using AF Form 847, Recommendation for Change of Publication. Provide an information copy to Headquarters USA Air Force (HQ USAF/SCMI), 1250 Air Force Pentagon, Washington DC 20330-1250, and HQ AFCA/TCBA-CTTA. The use of the name or mark of any specific manufacturer, commercial product, commodity, or service in this publication does not imply endorsement by the Air Force. See Attachment 1 for a glossary of references and supporting information.

DTIC

*Manuals; Computer Information Security; Telecommunication; Education*

**20020065570** Department of Energy, Washington, DC USA

**Final Technical Report on the Genome Sequence. DataBase (GSDB): DE-FG0395 ER 62062** ***Progress Report***

Sep. 1999; 10p; In English

Report No.(s): DE2002-755686; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Since September 1997 NCGR has produced two web-based tools for researchers to use to access and analyze data in the Genome Sequence Data Base (GSDB). These tools are: Sequence Viewer, a nucleotide sequence and annotation visualization tool, and MAR-Finder, a tool that predicts, based upon statistical inferences, the location of matrix attachment regions (MARs) within a nucleotide sequence. NCGR added sequence similarity search capabilities in the form of BLASTTM to the suite of tools available with GSDB, with user-friendly features such as the ability to create customized target databases. In addition, to augmenting the tools associated with GSDB, the quality of the data within GSDB was improved by continued, focused data curation. These efforts included the maintenance and updating of the SANBI STACK data set, sequence alignment sets, chromosome information for human sequences, and taxonomic information associated with sequences. NCGR deployed a new database record flat-file format that allowed users to access all of the information associated with sequences in the database.

NTIS

*Data Base Management Systems; Data Bases; Nucleotides; Genome*

**20020065578** Cornell Univ., Dept. of Computer Science, Ithaca, NY USA

**Building Interactive Digital Libraries of Formal Algorithmic Knowledge** ***Annual Report, 1 May 2001-30 Apr. 2002***

Constable, Robert L.; Jul. 02, 2002; 7p; In English

Contract(s)/Grant(s): N00014-01-1-0765

Report No.(s): AD-A403617; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This report summarizes the conceptual basis and the first prototype of an Interactive Digital Library of Formal Algorithmic Knowledge. The key purpose of the prototype library is to demonstrate that it is possible to organize formal knowledge that is necessary for the development of reliable hardware and software and to provide software tools for using it in a variety of ways.

DTIC

*Applications Programs (Computers); Digital Systems*

**20020065580** Naval Research Lab., Marine Geosciences Div., Stennis Space Center, MS USA

**System Documentation for the Geospatial Information DataBase (GIDB) System Server Version 2.0**

McCreedy, Frank; Ladner, Roy; Wilson, Ruth; Breckenridge, John; Carter, Susan; Jun. 24, 2002; 22p; In English

Report No.(s): AD-A403620; NRL/MR/7440-02-8275; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Geospatial Information DataBase (GIDB(Trademark)) offers a fully Object Oriented (OO) database approach to managing the input, storage, retrieval, and presentation of geospatial data in relation to a specific user defined area of interest (AOI). It uses both public domain and commercial OO database management systems (DBMS) technology to store and retrieve the data and can present this information in both 2D and 3D perspective views. It also offers the flexibility to query spatial data with reference to time and space.

DTIC

*Data Bases; Geographic Information Systems*

**20020066135** Colorado Univ., Boulder, CO USA

**Description of Data Archiving Activities** ***Final Report***

Simmons, K. E., Colorado Univ., USA; Aug. 01, 2002; 1p; In English

Contract(s)/Grant(s): NAG5-9590; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Data restoration and archiving activities for this project have resulted in the restoration of 100% of the original Mariner 9 raw data set as well as many of the secondary analysis data sets. These data sets have been submitted to the Planetary Data System (PDS) Atmospheric Node, long with their PDS labels and descriptive metadata.

Author

*Data Management; Data Systems; Mariner 9 Space Probe*

**20020066194** National Park Service, Water Resources Div., Fort Collins, CO USA

**Baseline Water Quality Data Inventory and Analysis: Chickamauga and Chattanooga National Military Park, Volume 3**

Oct. 2001; 526p; In English

Report No.(s): PB2002-106350; NPS/NRWRD/NRTR-99/254-Vol-3; No Copyright; Avail: CASI; A23, Hardcopy; A04, Microfiche

This document presents the results of surface-water-quality data retrievals for Chickamauga and Chattanooga National Military Park (CHCH) from six of the USA Environmental Protection Agency's (EPA) national databases: (1) Storage and Retrieval (STORET) water quality database management system; (2) River Reach File (RF3); (3) Industrial Facilities Discharge (IFD); (4) Drinking Water Supplies (DRINKS); (5) Water Gages (GAGES); and (6) Water Impoundments (DAMS). This document is one product resulting from a cooperative contractual endeavor between the National Park Service's (NPS) Servicewide Inventory and Monitoring Program, the National Park Service's Water Resources Division (WRD), and Horizon Systems Corporation to retrieve, format, and analyze surface water quality data for all units of the National Park System containing significant water resources. The primary goal of the project is to provide descriptive water quality information in a manner and format that is both consistent with the goals of the Servicewide Inventory and Monitoring Program and useable by park resource managers. The document provides: (1) a complete inventory of all retrieved water quality parameter data, water quality stations, and the entities responsible for the data collection; (2) descriptive statistics and appropriate graphical plots of water quality data characterizing period of record, annual, and seasonal central tendencies and trends; (3) a comparison of the park's water quality data to relevant EPA and WRD water quality screening criteria; and (4) an Inventory Data Evaluation and Analysis (IDEA) to determine what Servicewide Inventory and Monitoring Program 'Level 1' water quality parameters have been measured within the study area. Accompanying the report are disks containing digital copies of all data used in the report, as well as all components of the report (tables, figures. etc.).

NTIS

*Water Pollution; Surface Water; Water Quality; Water Sampling*

**20020066195** National Park Service, Water Resources Div., Fort Collins, CO USA

**Baseline Water Quality Data Inventory and Analysis: Chickamauga and Chattanooga National Military Park, Volume 2**

Oct. 2001; 516p; In English

Report No.(s): PB2002-106349; NPS/NRWRD/NRTR-99/254-Vol-2; No Copyright; Avail: CASI; A22, Hardcopy; A04, Microfiche

This document presents the results of surface-water-quality data retrievals for Chickamauga and Chattanooga National Military Park (CHCH) from six of the USA Environmental Protection Agency's (EPA) national databases: (1) Storage and Retrieval (STORET) water quality database management system; (2) River Reach File (RF3); (3) Industrial Facilities Discharge (IFD); (4) Drinking Water Supplies (DRINKS); (5) Water Gages (GAGES); and (6) Water Impoundments (DAMS). This document is one product resulting from a cooperative contractual endeavor between the National Park Service's (NPS) Servicewide Inventory and Monitoring Program, the National Park Service's Water Resources Division (WRD), and Horizon Systems Corporation to retrieve, format, and analyze surface water quality data for all units of the National Park System containing significant water resources. The primary goal of the project is to provide descriptive water quality information in a manner and format that is both consistent with the goals of the Servicewide Inventory and Monitoring Program and useable by park resource managers. The document provides: (1) a complete inventory of all retrieved water quality parameter data, water quality stations, and the entities responsible for the data collection; (2) descriptive statistics and appropriate graphical plots of water quality data characterizing period of record, annual, and seasonal central tendencies and trends; (3) a comparison of the park's water quality data to relevant EPA and WRD water quality screening criteria; and (4) an Inventory Data Evaluation and Analysis (IDEA) to determine what Servicewide Inventory and Monitoring Program 'Level 1' water quality parameters have been measured within the study area. Accompanying the report are disks containing digital copies of all data used in the report, as well as all components of the report (tables, figures. etc.).

NTIS

*Water Pollution; Surface Water; Water Quality; Water Sampling*

**20020066390** HighTower Software, Inc., Irvine, CA USA

**Finding Diamonds in the Rough**

Spinoff 2000; 2000, pp. 66-67; In English; Original contains color illustrations; ISBN 0-16-050462-7; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

HighTower Software, Inc. has developed a commercial software application originally designed at JPL that helps users identify deviations from norms out of massive quantities of data. The commercial product is known as CyberGrid and the same software is still supporting NASA's Voyager, Galileo and Cassini missions. CyberGrid generates 3-D graphs of data and has been used in AIDS research as well as e-commerce applications.
Author
*Technology Utilization; Norms; Fault Detection; Applications Programs (Computers); Computational Grids*

**20020066447** Marine Corps Development and Education Command, Quantico, VA USA
**The Effects of Multiple Constraints on the Army's Force Structure Documentation Process**
Handy, Eric D., Sr.; Jan. 2001; 56p; In English; Original contains color images
Report No.(s): AD-A403276; No Copyright; Avail: CASI; A04, Hardcopy

The System presently used by the army to document personnel force structure is heavily constrained and these constraints may effect the overall ability to produce a document that truly coincides with the desires of the prioritizer of the Army, the Deputy Chief of Staff for Operations (DCSOPS). This study involves defining, reviewing the history, and assessing the applicability and necessity of some of the major constraints imposed by directive, law, policy, doctrine, or guidance on Army Force Structure documentation. The intent is to show many of the difficulties encountered by the plans division of the Deputy Chief of Staff for Personnel (DCSPER) in the attempt to balance these constraints while properly aligning the Army's End Strength (ES).
DTIC
*Requirements; Records Management; Personnel; Military Technology*

**20020066484** National Aerospace Lab., Amsterdam, Netherlands
**Suitability of Genetic-Based Algorithms for Data Mining**
Choenni, S.; Nov. 1998; 34p; In English
Report No.(s): PB2002-105864; NLR-TP-98484; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Data mining has as goal to extract knowledge from large databases. To extract this knowledge, a database may be considered as a large search space, and a mining algorithm as a search strategy. In general, a search space consists of an enormous number of elements, making an exhaustive search infeasible. Therefore, efficient search strategies are of vital importance. Search strategies based on genetic-based algorithms have been applied successfully in a wide range of applications. In this paper, we discuss the suitability of genetic-based algorithms for data mining. We discuss the design and implementation of a genetic-based algorithm for data mining and illustrate its potentials.
NTIS
*Data Bases; Data Mining; Genetic Algorithms; Optimization*

**20020066485** National Aerospace Lab., Amsterdam, Netherlands
**Framework for Multi-Query Optimization**
Choenni, S.; Kersten, M.; Oct. 1997; 34p; In English
Report No.(s): PB2002-105880; NLR-TP-97563; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In some key database applications, a sequence of interdependent queries may be posed simultaneously to the DBMS. The optimization of such sequences is called multi-query optimization, and it attempts to exploit these dependencies in the derivation of a query evaluation plan (qep). Although it has been observed and demonstrated by several researchers that exploitation of dependencies speed up the query processing, limited research has been reported how to benefit from multi-query optimization, taking the capabilities of existing query optimizers into account. This is exactly the topic of this paper. Since existing optimizers are able to optimize queries in which a restricted number of basic operations appears, e.g., number of joins is limited to ten, and the optimization of a query is relatively expensive, we attempt to profit from multi query optimization under the condition that queries are passed only once and separately to the optimizer. We propose a two-step optimization procedure. In the first step, we determine, on the basis of the dependencies between queries, in which order they should be specified and what results should be stored. In the second step, each query is passed separately to an optimizer.
NTIS
*Optimization; Data Bases; Computerized Simulation; Query Languages*

**20020066520** NASA Langley Research Center, Hampton, VA USA

**NASA Patent Abstracts Bibliography: A Continuing Bibliography, Supplement 61**

July 2002; 73p; In English

Report No.(s): NASA/SP-2002-7039/SUPPL61; NAS 1.21:7039/SUPPL61; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report lists reports, articles and other documents recently announced in the NASA STI Database. Several thousand inventions result each year from the aeronautical and space research supported by the National Aeronautics and Space Administration. The inventions having important use in government programs or significant commercial potential are usually patented by NASA. These inventions cover practically all fields of technology and include many that have useful and valuable commercial application. NASA inventions best serve the interests of the USA when their benefits are available to the public. In many instances, the granting of nonexclusive or exclusive licenses for the practice of these inventions may assist in the accomplishment of this objective. This bibliography is published as a service to companies, firms, and individuals seeking new, licensable products for the commercial market. The NASA Patent Abstracts Bibliography is a semiannual NASA publication containing comprehensive abstracts of NASA owned inventions covered by U.S. patents. The citations included in the bibliography arrangement of citations were originally published in NASA's Scientific and Technical Aerospace Reports (STAR) and cover STAR announcements made since May 1969. The citations published in this issue cover the period December 2001 through July 2002. This issue includes 10 major subject divisions separated into 76 specific categories and one general category/division. (See Table of Contents for the scope note of each category, under which are grouped appropriate NASA inventions.) This scheme was devised in 1975 and revised in 1987 in lieu of the 34 category divisions which were utilized in supplements (01) through (06) covering STAR abstracts from May 1969 through January 1974. Each entry consists of a STAR citation accompanied by an abstract and, when appropriate, a key illustration taken from the patent or application for patent. Entries are arranged by subject category in ascending order. A typical citation and abstract presents the various data elements included in most records cited. This appears after the table of contents.

Derived from text

*Bibliographies; NASA Programs; Aerospace Engineering; Technology Utilization; Patent Policy*

**20020066681** General Accounting Office, Washington, DC USA

**Critical Infrastructure Protection: Federal Efforts Require a More Coordinated and Comprehensive Approach for Protecting Information Systems**

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

Report No.(s): PB2002-108149; GAO-02-474; No Copyright; Avail: National Technical Information Service (NTIS)

Critical infrastructure protection (CIP) involves activities that enhance the security of our nation's cyber and physical public and private infrastructures that are essential to national security, national economic security, and/or national public health and safety. On October 16, 2001, President Bush issued Executive Order 13231, 'Critical Infrastructure Protection in the Information Age,' which continues many Presidential Decision Directive 63 activities by focusing on cyberthreats to critical infrastructures, and also created the President's Critical Infrastructure Protection Board to coordinate federal cybersecurity efforts. In response to your request, we reviewed federal organizations involved in national or multiagency cyber CIP activities. Specifically, our objectives were to (1) identify the federal civilian, defense, and intelligence organizations involved in protecting critical infrastructures from computer based attacks, and their responsibilities, current organizational placement, and source of authority; (2) identify the organizations' relationships with each other; and (3) determine appropriated CIP funds for each organization. As agreed with your staff, we concentrated on federal organizations identified in Presidential Decision Directive 63 or Executive Order 13231 that have a national or multiagency cyber CIP focus and did not address organizations involved solely in CIP activities specific to their department or agency, such as the agencies' critical infrastructure assurance offices. For example, although organizations such as the Federal Aviation Administration, the Centers for Disease Control, the Financial Management Service, and the National Weather Service are responsible for the security of critical cyber systems, they do not have national cyber CIP responsibilities outside their agencies. In addition, other information security organizations that receive federal funding were not included in our review. Further details on our objectives, scope, and methodology are provided in appendix I.

NTIS

*Information Systems; Computer Information Security; Congressional Reports*

## 84
## LAW, POLITICAL SCIENCE AND SPACE POLICY

*Includes: aviation law; space law and policy; international law; international cooperation; and patent policy*

**20020066531** International Boundary and Water Commission, El Paso, TX USA
**International Boundary and Water Commission USA and Mexico**
2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): PB2002-107888; No Copyright; Avail: National Technical Information Service (NTIS)

The International Boundary and Water Commission, USA and Mexico (IBWC), has undergone still another phase in the last five years, in this more than 100 year old experience by the Governments of the USA and Mexico of entrusting their boundary and water relationship in an international organizations located at the border and serving the border. The period coincides with the first five years of the North America Free Trade Agreement (NAFTA) which in addition to opening commerce between the USA, Mexico and Canada, has also brought about additional environmental cooperation agreements.
NTIS
*Water Resources; Water Quality; Resources Management; USA; Mexico*

**20020066532** International Boundary and Water Commission, El Paso, TX USA
**Report of the USA Section International Boundary and Water Commission, 1997-1998**
2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM
Report No.(s): PB2002-107889; No Copyright; Avail: National Technical Information Service (NTIS)

The USA and Mexico entrust to their International Boundary and Water Commission (IBWC) the application of obligations and rights assumed in their boundary and water treaties and other International agreements following the foreign policy guidance of the U.S. Department of State and Mexico's Secretariat of Foreign Relations. The IBWC is made up of a USA Section (USIBWC) and a Mexican Section (MxIBWC). The report covers the activities in 1997 and 1998 of the USA Section of the IBWC.
NTIS
*USA; International Cooperation*

## 85
## TECHNOLOGY UTILIZATION AND SURFACE TRANSPORTATION

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

**20020066165** NASA Marshall Space Flight Center, Huntsville, AL USA
**Benefits Awareness: Educating Industry, Finance, and the Public About Space Commercialization**
Powers, Blake, NASA Marshall Space Flight Center, USA; Nall, Mark, NASA Marshall Space Flight Center, USA; Casas, Joseph C., NASA Marshall Space Flight Center, USA; [2002]; 8p; In English; 23rd International Symposium on Space Technology and Science, 26 May - 2 Jun. 2002, Matsue, Japan; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

For space to be truly commercialized, businesses of all sizes and types must be involved, from foundries to agricultural research initiatives. Achieving this goal, however, requires three separate but integrated educational efforts to support it. The first is to educate industry leaders about the possibilities available through such research, while dispelling some of the myths and misinformation educate the financial community about the economic benefits that result both from the research and the leveraging of private research dollars through the use of space and microgravity research. The third is to educate the public about the tangible benefits that come directly to them from such efforts, the economic benefits to national economies from same, and the other less tangible benefits that will cascade from commercial operations. Together, these steps will educate and provide the framework necessary to help advance space commercialization.
Author
*Space Commercialization; Education; Finance; Economics; Commerce; Agriculture*

**20020066598** Physics and Electronics Lab. TNO, The Hague, Netherlands
**Report on Transportation Management *Final Report Zicht op Mobiliteitsalternatieven KL***
Verweij, E. D. N., Physics and Electronics Lab. TNO, Netherlands; February 2002; 90p; In Dutch; Original contains color illustrations

Contract(s)/Grant(s): A01/KL/892; TNO Proj. 31526
Report No.(s): TD-01-0250; FEL-01-A279; Copyright; Avail: Issuing Activity

The Royal Netherlands Army (RNLA) is investigating how transport management can be used for passenger travel of its personnel and visitors. To support this, TNO has performed a literary study on soft (i.e. difficult to quantify) pros and cons of alternatives for commuter traffic. The study focuses on passenger travel under nonoperational circumstances. About thirty sources have been used for this study. Sources have been found by scanning the internet and browsing through library systems. One of the conclusions is that, before the RNLA can usefully apply transport management, it should map the locations of its units, the business types of these units, how far away from their work personnel live and how much business traffic is generated by each location, Also, this study has shown that there is indeed little quantified information available on pros and cons of commuter traffic alternatives.

Author

*Transportation; Assessments; Human Resources; Management Planning; Traffic Control; Literature*

## 89
## ASTRONOMY

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

**20020066136** Harvard Coll. Observatory, Cambridge, MA USA

**X-ray Spectroscopy of Low-Luminosity Active Galactic Nuclei with XMM** ***Final Report, 1 Jan. - 30 Nov. 2001***

DiMatteo, Tiziana, Harvard Coll. Observatory, USA; [2002]; 1p; In English

Contract(s)/Grant(s): NAG5-10105; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The measurement of black hole masses in nearby galaxies has transformed our understanding of these systems, allowing us to quantify the relevant scales of power, length and time and explore how the activity of black holes is linked to their environments and to the evolution of their host galaxies. In this project, Dr. Tiziana Di Matteo has the primary responsibility for developing and investigating theoretical models for the origin of the X-ray emission observed in low-luminosity AGN. Dr. Di Matteo has been involved in interpreting X-ray data and assessing accretion models throughout the project.

Author

*Black Holes (Astronomy); Astronomical Models; Active Galactic Nuclei; X Ray Spectroscopy*

**20020066649** NASA Goddard Space Flight Center, Greenbelt, MD USA

**Observational Signatures of Black Holes: Spectral and Temporal Features of XTE J1550-564**

Titarchuk, Lev, NASA Goddard Space Flight Center, USA; Shrader, C. R., NASA Goddard Space Flight Center, USA; [2002]; 26p; In English

Report No.(s): astro-ph/0111272-Vol-1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The theoretical predictions of the converging inflow, or Bulk-Motion Comptonization model are discussed and some predictions are compared to X- and gamma-ray observations of the high-soft state of Galactic black hole candidate XTE J1550+564. The approx. 10(exp 2)-Hz QPO phenomenon tends to be detected in the high-state at times when the bolometric luminosity surges and the hard-powerlaw spectral component is dominant. Furthermore, the power in these features increases with energy. We offer interpretation of this phenomenon, as oscillations of the innermost part of the accretion disk, which in turn supplies the seed photons for the converging inflow where the hard power-law is formed through Bulk Motion Comptonization (BMC). We further argue that the noted lack of coherence between intensity variations of the high-soft-state low and high energy bands is a natural consequence of our model, and that a natural explanation for the observed hard and soft lag phenomenon is offered. In addition, we address some criticisms of the BMC model supporting our claims with observational results.

Author

*Black Holes (Astronomy); Compton Effect; Gamma Rays; Predictions*

**20020066737** NASA Goddard Space Flight Center, Greenbelt, MD USA

**SHEEP: The Search for the High Energy Extragalactic Population**

Nandra, K., NASA Goddard Space Flight Center, USA; Georgantopoulos, I., National Observatory of Athens, Greece; Ptak, A., Carnegie-Mellon Univ., USA; Turner, T. J., NASA Goddard Space Flight Center, USA; [2002]; 36p; In English

Contract(s)/Grant(s): NAG5-7067; NAG5-7538; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present the SHEEP survey for serendipitously-detected hard X-ray sources in ASCA GIS images. In a survey area of approx. 40 sq deg, 69 sources were detected in the 5-10 keV band to a limiting flux of approx. 10(exp -13) erg/sq cm/s. The number counts agree with those obtained by the similar BeppoSAX HELLAS survey, and both are in close agreement with ASCA and BeppoSAX 2-10 keV surveys. Spectral analysis of the SHEEP sample reveals that the 2-10 and 5-10 keV surveys do not sample the same populations, however, as we find considerably harder spectra, with an average Gamma approx. 1.0 assuming no absorption. The implication is that the agreement in the number counts is coincidental, with the 5-10 keV surveys gaining approximately as many hard sources as they lose soft ones, when compared to the 2-10 keV surveys. This is hard to reconcile with standard AGN ”population synthesis” models for the X-ray background, which posit the existence of a large population of absorbed sources. We find no evidence of the population hardening at faint fluxes, with the exception that the few very brightest objects are anomalously soft. 53 of the SHEEP sources have been covered by ROSAT in the pointed phase. of these 32 were detected. An additional 3 were detected in the RASS. As expected the sources detected with ROSAT are systematically softer than those detected with ASCA alone, and of the sample as a whole. Although they represent a biased subsample, the ROSAT positions allow relatively secure catalog identifications to be made. We find associations with a wide variety of AGN and a few clusters and groups. At least two X-ray sources identified with high-z QSOs present very hard X-ray spectra indicative of absorption, despite the presence of broad optical lines. A possible explanation for this is that we are seeing relatively dust-free ”warm absorbers” in high luminosity/redshift objects. Our analysis defines a new, hard X-ray selected sample of objects - mostly active galactic nuclei - which is less prone to bias due to obscuration than previous optical or soft X-ray samples. They are therefore more representative of the population of AGN in the universe in general, and the SHEEP survey should produce bright examples of the sources that make up the hard X-ray background, the majority of which has recently been resolved by Chandra. This should help elucidate the nature of the new populations.

Author

*Active Galactic Nuclei; X Ray Sources; Spectrum Analysis; X Ray Spectra; Luminosity*

**20020066741** NASA Goddard Space Flight Center, Greenbelt, MD USA

**Production and Performance of the InFOCmicronS 20-40 keV Graded Multilayer Mirror**

Berendse, F., Maryland Univ., USA; Owens, S. M., NASA Goddard Space Flight Center, USA; Serlemitsos, P. J., NASA Goddard Space Flight Center, USA; Tueller, J., NASA Goddard Space Flight Center, USA; Chan, K.-W., NASA Goddard Space Flight Center, USA; Soong, Y., NASA Goddard Space Flight Center, USA; Krimm, H., NASA Goddard Space Flight Center, USA; Baumgartner, W. H., NASA Goddard Space Flight Center, USA; Tamura, K., Nagoya Univ., Japan; Okajima, T., Nagoya Univ., Japan; Tawara, Y., Nagoya Univ., Japan; [2002]; 44p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The International Focusing Optics Collaboration for micron Crab Sensitivity (InFOC micronS) balloon-borne hard x-ray incorporates graded multilayer technology to obtain significant effective area at energies previously inaccessible to x-ray optics. The telescope mirror consists of 2040 segmented thin aluminum foils coated with replicated Pt/C multilayers. A sample of these foils was scanned using a pencil-beam reflectometer to determine, multilayer quality. The results of the reflectometer measurements demonstrate our capability to produce large quantity of foils while maintaining high-quality multilayers with a mean Nevot-Croce interface roughness of 0.5nm. We characterize the performance of the complete InFOC micronS telescope with a pencil beam raster scan to determine the effective area and encircled energy function of the telescope. The effective area of the complete telescope is 78, 42 and 22 square centimeters at 20 30 and 40 keV. respectively. The measured encircled energy fraction of the mirror has a half-power diameter of 2.0 plus or minus 0.5 arcmin (90% confidence). The mirror successfully obtained an image of the accreting black hole Cygnus X-1 during a balloon flight in July, 2001. The successful completion and flight test of this telescope demonstrates that graded-multilayer telescopes can be manufactured with high reliability for future x-ray telescope missions such as Constellation-X.

Derived from text

*Telescopes; Segmented Mirrors; Multilayer Insulation; X Ray Optics; Metal Foils; Balloon-Borne Instruments; Flight Tests*

**20020066768** Smithsonian Astrophysical Observatory, Cambridge, MA USA

**ISO Guest Observer Data Analysis and LWS Instrument Team Activities** ***Annual Report, 1 Aug. 2001 - 31 Jul. 2002***

Smith, Howard, Smithsonian Astrophysical Observatory, USA; August 2002; 1p; In English

Contract(s)/Grant(s): NAG5-7394; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This project was granted a no-cost extension prompted by the request of the major subcontractor, the Naval Research Laboratory, which had not yet completed its tasks. As of July 2002, they had made substantial progress. They have successfully fabricated a metal mesh grid on polyimide, and also successfully fabricated a 2-layer metal mesh infrared filter using stacks of these metal mesh grids on polyimide; the actual layering was done at SAO. Both warm and cold spectroscopic tests were done on these fabricated devices. The measurements were in good agreement with the theory, and also reasonable performance in

absolute terms. NRL is now working on fabricating a 3-layer metal mesh infrared filter, and a prototype is expected in the next month. Testing should occur before the end of the fiscal year. Finally, NRL has preliminarily agreed to hire a new postdoctoral person to refine the modeling of the filters based on the new measurements. The person should arrive this fall. NRL has a new Fourier Transform Spectrometer which will be delivered in the next month, and which will be used to facilitate the testing which has up to now been done in collaboration with NASA Goddard Space Flight Space Center.
Author
*Data Processing; Fabrication; Astrophysics; Infrared Space Observatory (ISO); Spaceborne Astronomy; Satellite Instruments*

**20020066770** NASA Goddard Space Flight Center, Greenbelt, MD USA
**Status and Progress on the Upgraded Infrared Spatial Interferometer**
Danchi, W. C., NASA Goddard Space Flight Center, USA; Townes, C. H., California Univ., USA; Fitelson, W., California Univ., USA; Hale, D., California Univ., USA; Monnier, J., Harvard-Smithsonian Center for Astrophysics, USA; Tevosian, S., California Univ., USA; Weiner, J., California Univ., USA; [2002]; 1p; In English; SPIE Conference, 22-28 Aug. 2002, Waikoloa, HI, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The U.C. Berkeley Infrared Spatial Interferometer is a two telescope stellar interferometer operating in the 9-12 micron atmospheric window, utilizing heterodyne detection with CO2 laser local oscillators. Science with the ISI has been focused on the measurements of the spatial distribution of dust and molecules around mass-losing late type stars, and more recently precision measurements of stellar diameters in the mid-infrared avoiding molecular lines. Also during the past few years, a NSF sponsored program of expansion from two to three telescopes has been underway. This expansion will allow the ISI to make visibility observations on three simultaneous baselines and a measure a closure phase. The third telescope was completed last year and shipped to Mt. Wilson, and more recently a Central Control Facility and Master Laser Oscillator Facility were also completed and recently shipped to Mt. Wilson. In this talk we report progress on this program and highlight some of the most recent astrophysical results.
Author
*Astrophysics; Infrared Interferometers; Stellar Mass; Molecular Spectra; Spatial Distribution*

**20020066771** Smithsonian Astrophysical Observatory, Cambridge, MA USA
**Simultaneous Spectral and Timing Observations of Accreting Neuron Stars** ***Final Report, 1 Mar. 2000 - 28 Feb. 2002***
Kaaret, P., Smithsonian Astrophysical Observatory, USA; July 2002; 1p; In English
Contract(s)/Grant(s): NAG5-9104; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The goal of this proposal is to perform simultaneous x-ray spectral and millisecond timing observations of accreting neutron stars to further our understanding of their accretion dynamics and in the hope of using these systems as probes of the physics of strong gravitational fields. NAG5-9104 is the successor grant to NAG5-8408. Observations using the Rossi X-Ray Timing Explorer (RXTE) and BeppoSAX were performed of 4U1702-429, 4U1735-44, and Cyg X-2. Unfortunately, only a small fraction of the approved observing time was obtained for the first two targets and the data are of limited scientific value. Data analysis has been completed on the observations of Cyg X-2. We discovered a correlation between the frequency of the horizontal branch oscillations (HBO) and a soft, thermal component of the x-ray spectrum likely associated with emission from the accretion disk. This correlation may place constraints on models of the oscillations. A paper based on these results appeared in the Astrophysical Journal.
Author
*Accretion Disks; Neutron Stars; Time Measurement; Oscillations; Gravitational Fields*

**20020067416** NASA Marshall Space Flight Center, Huntsville, AL USA
**Chandra Observations of Unresolved X-Ray Sources Around Two Clusters of Galaxies**
Molnar, Sandor M., Rutgers Univ., USA; Hughes, John P., Rutgers Univ., USA; Donahue, Megan, Space Telescope Science Inst., USA; Joy, Marshall, NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

We have searched for unresolved X-ray sources in the vicinity of two rich clusters of galaxies: Abell 1995 (A1995) and MS 0451.6-0305 (MS0451), using the Chandra X-ray observatory. We detected significantly more unresolved sources around A1995 than expected based on the number of X-ray sources to the same flux limit detected in deep Chandra observations of blank fields. Previous studies have also found excess X-ray sources in the vicinity of several nearby clusters of galaxies using ROSAT (Roentgen Satellite), and recently in more distant (z is approximately 0.5) clusters (RXJ0030 and 3C295) using Chandra. In contrast, we detect only 14 unresolved X-ray sources near MS0451, which is consistent with the number expected from a cluster-free background. We determine the luminosity functions of the extra sources under the assumption that they are at the

distance of their respective clusters. The characteristic luminosity of the extra sources around A1995 must be an order of magnitude fainter than that of the extra sources around RXJ0030 and 3C295. The apparent lack of extra sources around MS0451 is consistent with its greater distance and the same characteristic luminosity as the A1995 sources. Hardness ratios suggest that, on average, the extra sources in A1995 may have harder spectra than those of RXJ0030 and 3C295. These results indicate that different classes of objects may dominate in different clusters, perhaps depending on the formation history and/or dynamical state of the accompanying cluster.
Author
*Galactic Clusters; X Ray Astrophysics Facility; X Ray Sources; X Ray Astronomy*

**20020067453** NASA Marshall Space Flight Center, Huntsville, AL USA
**Chandra X-ray Observations of the Spiral Galaxy M81**
Swartz, Douglas A., NASA Marshall Space Flight Center, USA; Ghosh, Kajal K., NASA Marshall Space Flight Center, USA; McCollough, Michael L., NASA Marshall Space Flight Center, USA; Pannuti, Thomas G., NASA Marshall Space Flight Center, USA; Tennant, Allyn F., NASA Marshall Space Flight Center, USA; Wu, Kinwah, NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

A Chandra X-Ray Observatory ACIS-S (Advanced X-ray Astrophysics Facility (Chandra) CCD (Charge Coupled Device) Imaging Spectrometer) imaging observation is used to study the population of X-ray sources in the nearby Sab galaxy M81 (NGC 3031). A total of 177 sources are detected with 124 located within the D25 isophote to a limiting X-ray luminosity of 3e36 ergs/cm(exp 2)/s. Source positions, count rates, luminosities in the 0.3-8.0 keV band, limiting optical magnitudes, and potential counterpart identifications are tabulated. Spectral and timing analysis of the 36 brightest sources are reported including the low luminosity active galactic nucleus, SN 1993J, and the Einstein discovered ultraluminous X-ray source X6.
Author
*X Ray Astrophysics Facility; X Ray Sources; X Ray Astronomy*

**20020067583** NASA Goddard Space Flight Center, Greenbelt, MD USA
**A High-Speed, Event-Driven, Active Pixel Sensor Readout for Photon-Counting Microchannel Plate Detectors**
Kimble, Randy A., NASA Goddard Space Flight Center, USA; Pain, Bedabrata, Jet Propulsion Lab., California Inst. of Tech., USA; Norton, Timothy J., Raytheon Information Technology and Scientific Services, USA; Haas, J. Patrick, NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; SPIE Astronomical Telescopes and Instrumentation, 22-28 Aug. 2002, Waikoloa, HI, USA; Sponsored by International Society for Optical Engineering, USA
Contract(s)/Grant(s): RTOP 188-01-11; No Copyright; Avail: Issuing Activity; Abstract Only

Silicon array readouts for microchannel plate intensifiers offer several attractive features. In this class of detector, the electron cloud output of the MCP intensifier is converted to visible light by a phosphor; that light is then fiber-optically coupled to the silicon array. In photon-counting mode, the resulting light splashes on the silicon array are recognized and centroided to fractional pixel accuracy by off-chip electronics. This process can result in very high (MCP-limited) spatial resolution while operating at a modest MCP gain (desirable for dynamic range and long term stability). The principal limitation of intensified CCD systems of this type is their severely limited local dynamic range, as accurate photon counting is achieved only if there are not overlapping event splashes within the frame time of the device. This problem can be ameliorated somewhat by processing events only in pre-selected windows of interest of by using an addressable charge injection device (CID) for the readout array. We are currently pursuing the development of an intriguing alternative readout concept based on using an event-driven CMOS Active Pixel Sensor. APS technology permits the incorporation of discriminator circuitry within each pixel. When coupled with suitable CMOS logic outside the array area, the discriminator circuitry can be used to trigger the readout of small sub-array windows only when and where an event splash has been detected, completely eliminating the local dynamic range problem, while achieving a high global count rate capability and maintaining high spatial resolution. We elaborate on this concept and present our progress toward implementing an event-driven APS readout.
Author
*Microchannel Plates; Radiation Detectors; Charge Coupled Devices; Fiber Optics*

**20020067637** NASA Goddard Space Flight Center, Greenbelt, MD USA
**Data Analysis for the SOLIS Vector Spectromagnetograph**
Jones, Harrison P., NASA Goddard Space Flight Center, USA; Harvey, John W., National Solar Observatory, USA; [2002]; 1p; In English; International Astronomical Union Colloquium 188: Magnetic Coupling on the Solar Atmosphere, 30 May - 18 Jun. 2002, Naples, Italy; Sponsored by International Astronomical Union, UK; No Copyright; Avail: Issuing Activity; Abstract Only

The National Solar Observatory's SOLIS Vector Spectromagnetograph (VSM), which will produce three or more full-disk maps of the Sun's photospheric vector magnetic field every day for at least one solar magnetic cycle, is in the final stages of assembly. Initial observations, including cross-calibration with the current NASA/NSO spectromagnetograph (SPM) will soon be carried out at a test site in Tucson. This paper discusses data analysis techniques for reducing the raw data, calculation of line-of-sight magnetograms and both quick-look and high-precision inference of vector fields from Stokes spectral profiles. Existing SPM algorithms, suitably modified to accomodate the cameras, scanning pattern, and polarization calibration optics for the VSM, will be used to "clean" the raw data and to process line-of-sight, magnetograms. A recent. version of the High Altitude Observatory Milne-Eddington (HAO-ME) inversion code (Skumanich and Lites; 1987, 11)J 322, p. 473) will he used for high-precision vector fields since the algorithm has been extensively tested, is well understood, and is fast enough to complete data analysis within 24 hours of data acquisition. The simplified inversion algorithm of Auer, Heasley. arid House (1977, Sol. Phys. 55, p. 47) forms the initial guess for this version of the HAO-ME code and will be used for quick-look vector analysis of VSM data since its performance on simulated Stokes profiles is better than other candidate methods. Improvements (e.g., principal components analysis or neural networks) are under consideration and will be straightforward to implement. However, current resources are sufficient to store the original Stokes profiles only long enough for high-precision analysis. Retrospective reduction of Stokes data with improved methods will not be possible, and modifications will only be introduced when the advantages of doing so are compelling enough to justify discontinuity in the long-term data stream.
Author
*Principal Components Analysis; Magnetic Signatures; Data Flow Analysis; Vector Analysis; Solar Magnetic Field*

**20020067639** NASA Goddard Space Flight Center, Greenbelt, MD USA
**The Science Goals of NGST's Near-Infrared Camera**
Gardner, Jonathan P., NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; SPIE Astronomical Telescopes and Instrumentation, 22-28 Aug. 2002, Waikoloa, HI, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

We discuss the science goals of NGST's Near-Infrared Camera, and their implications for its design.
Author
*Design Analysis; Cameras; Near Infrared Radiation*

## 90
## ASTROPHYSICS

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

**20020065354** Washington Univ., Nuclear Physics Lab., Seattle, WA USA
**[Activities of Nuclear Physics Lab., Washington University]** ***Annual Report***
Apr. 1999; 86p; In English
Report No.(s): DE2002-762169; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Nuclear Physics Laboratory at the University of Washington in Seattle pursues a broad program of nuclear physics research. Research activities are conducted locally and at remote sites. The current program includes 'in-house' research on nuclear collisions using the local tandem Van de Graaff and superconducting linac accelerators as well as local and remote non-accelerator research on fundamental symmetries and weak interactions and user-mode research on relativistic heavy ions at large accelerator facilities around the world. Our results on hot Giant Dipole Resonance decay reverse longstanding conventional wisdom that the GDR width saturates at moderate excitation energy. We show, based on new pre-equilibrium and GDR decay measurements, together with a reanalysis of previous experiments, that the GDR width does not saturate, but appears to continue growing with excitation energy (temperature) in accord with theoretical expectations. These experiments are fundamental to understanding hot nuclear matter, in particular how normal modes of nuclear oscillation survive at high temperatures.
NTIS
*Astrophysics; Atomic Physics; Nuclear Physics; Research and Development*

**20020066641** California Univ., Dept. of Astronomy, Berkeley, CA USA
**Studies of Dust Emission as Measured by DIRBE and IRAS** ***Final Report, 15 Dec. 1998 - 14 Dec. 2001***
Davis, Marc, California Univ., USA; [2002]; 3p; In English
Contract(s)/Grant(s): NAG5-7833; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The main activity supported by this grant was to make the dust reddening map more useful for optical and microwave astronomy, and to increase our understanding of interstellar dust in general. We completed all the major objectives of the proposal, and we are eagerly awaiting the launch of Space Infrared Telescope Facility (SIRTF) so that we can check one of our most controversial conclusions. According to the ADS abstract service, the above paper has been cited 895 times. A number of authors have claimed the SFD98 dust maps are miscalibrated, but recent work suggests that the calibration is correct. The primary goal of this ADP grant was to determine the microwave / sum-mm spectrum of interstellar dust emission by cross-correlating the Far Infrared Absolute Spectrophotometer (FIRAS) spectra with a model based on the SFD98 dust map. Because of temperature variation, large (factor of two) variations are observed in submillimeter / 100 micron ratio, so a careful accounting of dust temperature data, based on Diffuse Infrared Background Experiment (DIRBE) 100 and 240 micron channels, was required. Even this improvement was unable to reduce the chi(sup 2) per degree of freedom below 30. Further study revealed that a two-component model, with the two components having different (but reasonable) optical properties, achieved a decrease in chi(sup 2) to less than 2, five times better than the next best fit in the literature. The resulting model uses density and temperature estimates based on DIRBE data, with only four global parameters fit using the FIRAS data. This dramatic reduction in chi(sup 2) using only four fit parameters may indicate that the model is physically correct, but in any case, it is an acceptable phenomenological model. We have released the appropriate data and software on our website (http://astro.berkeley.edu/dust) to allow users to compute the interstellar dust emission between from 100-3000 GHz (or 100 micron 3 mm) with approx. 15% precision. The paper describing these efforts appeared in ApJ 524, 867. This paper has to date been cited 24 times.
Author

*Cosmic Dust; Red Shift; Background Radiation; Astrography; Calibrating; Infrared Radiation; Astronomical Maps*

**20020066651** Smithsonian Astrophysical Observatory, Cambridge, MA USA

**Development and Operations of the Astrophysics Data System** ***Final Report, 1 Apr. 1997 - 31 Dec. 2001***

Murray, Stephen S., Smithsonian Astrophysical Observatory, USA; July 2002; 22p; In English

Contract(s)/Grant(s): NCC5-189; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The ADS was represented at the AAS meeting in San Diego with an oral talk and a demonstration. The demonstration was hugely successful, especially in light of the fact that the meeting was attended by about 1,200 Physics teachers. This was a group that we had no contact with before. They were very interested in the ADS. Having made contact with this group should help to further propagate knowledge about the ADS in the Physics community and bring it to the attention of young scientists. Two new mirror sites were established, one in India and in Russia. The site in India is fully operational, the site in Russia is waiting for the data tapes to be loaded. The preprint database is already functional. The mirror site in India is expected to become a full article mirror site soon. The mirror site in Russia is expected to become a partial article mirror site in the near future. The mirror site in China now has a full article mirror. This is the second full article mirror site after the one in Japan. The mirror site at the CDS in France is working on configuring disks for another full article mirror.
Author

*Data Systems; Astrophysics; Data Bases*

**20020066735** Pittsburgh Univ., Dept. of Physics and Astronomy, Pittsburgh, PA USA

**The Luminosity Function of QSO Host Galaxies**

Hamilton, Timothy S., Pittsburgh Univ., USA; Casertano, Stefano, Space Telescope Science Inst., USA; Turnshek, David A., Pittsburgh Univ., USA; [2002]; 36p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present some results from our HST archival image study of 71 QSO host galaxies. The objects are selected to have z less than or equal to 0.46 and total absolute magnitude M(sub v) less than or equal to -23 in our adopted cosmology (H(sub 0) = 50 kilometers per second Mpc(sup-1), q(sub 0) = 0.5, lambda = 0)). The aim of this initial study is to investigate the composition of the sample with respect to host morphology and radio loudness, as well as derive the QSO host galaxy luminosity function. We have analyzed available WFPC2 images in R or I band (U in one case), using a uniform set of procedures. The host galaxies span a narrow range of luminosities and are exceptionally bright, much more so than normal galaxies, usually L greater than L*(sub v). The QSOs are almost equally divided among three subclasses: radio-loud QSOs with elliptical hosts, radio-quiet QSOs with elliptical hosts, and radio-quiet QSOs with spiral hosts. Radio-loud QSOs with spiral hosts are extremely rare. Using a weighting procedure, we derive the combined luminosity function of QSO host galaxies. We find that the luminosity function of QSO hosts differs in shape from that of normal galaxies but that they coincide at the highest luminosities. The ratio of the number of quasar hosts to the number of normal galaxies at a luminosity L*(sub v) is R = (Lv/11.48L*(sub v))(sup 2.46), where L*(sub v) corresponds to M*(sub v)= -22.35, and a QSO is defined to be an object with total nuclear plus host light M(sub v) less than

or equal to -23. This ratio can be interpreted as the probability that a galaxy with luminosity L(sub V) will host a QSO at redshift z approximately equal to 0.26.
Author
*Cosmology; Galaxies; Quasars; Stellar Luminosity; Radio Astronomy*

**20020066738** NASA Goddard Space Flight Center, Greenbelt, MD USA
**The Fourier-Kelvin Stellar Interferometer Mission Concept**
Danchi, W. C., NASA Goddard Space Flight Center, USA; Allen, R., California Univ., USA; Benford, D., NASA Goddard Space Flight Center, USA; Gezari, D., NASA Goddard Space Flight Center, USA; Leisawitz, D., NASA Goddard Space Flight Center, USA; Mundy, L., Harvard-Smithsonian Center for Astrophysics, USA; [2002]; 1p; In English; SPIE Conference, 22-28 Aug. 2002, Waikoloa, HI, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The Fourier-Kelvin Stellar Interferometer (FKSI) is a mission concept for an imaging interferometer for the mid-infrared spectral region (5-30 microns). FKSI is conceived as a scientific and technological precursor to TPF as well as Space Infrared Interferometric Telescope (SPIRIT), Submillimeter Probe Evolution of Cosmic Structure (SPECS), and Single Aperture for Infrared Observatory (SAFIR). It will also be a high angular resolution system complementary to Next Generation Space Telescope (NGST). The scientific emphasis of the mission is on the evolution of protostellar systems, from just after the collapse of the precursor molecular cloud core, through the formation of the disk surrounding the protostar, the formation of planets in the disk, and eventual dispersal of the disk material. FKSI will also search for brown dwarfs and Jupiter mass and smaller planets, and could also play a very powerful role in the investigation of the structure of active galactic nuclei and extra-galactic star formation. We are in the process of studying alternative interferometer architectures and beam combination techniques, and evaluating the relevant science and technology tradeoffs. Some of the technical challenges include the development of the cryocooler systems necessary for the telescopes and focal plane array, light and stiff but well-damped truss systems to support the telescopes, and lightweight and coolable optical telescopes. The goal of the design study is to determine if a mid-infrared interferometry mission can be performed within the cost and schedule requirements of a Discovery class mission. At the present time we envision the FKSI as comprised of five one meter diameter telescopes arranged along a truss structure in a linear non-redundant array, cooled to 35 K. A maximum baseline of 20 meters gives a nominal resolution of 26 mas at 5 microns. Using a Fizeau beam combination technique, a simple focal plane camera could be used to obtain both Fourier and spectral data simultaneously for a given orientation of the array. The spacecraft will be rotated to give sufficient Fourier data to reconstruct complex images of a broad range of astrophysical sources.
Author
*Astrophysics; Imaging Techniques; Interferometers; Fourier Transformation; Protostars; Stellar Evolution; Space Missions*

**20020066739** NASA Goddard Space Flight Center, Greenbelt, MD USA
**Comet and Asteroid Hazard to the Terrestrial Planets**
Ipatov, S. I., NASA Goddard Space Flight Center, USA; Mather, J. C., NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; COSPAR, 10-13 Oct. 2002, Houston, TX, USA
Contract(s)/Grant(s): NRC-0158730; INTAS-00-240; RFBR-01-02-17540; NAG5-10776; No Copyright; Avail: Issuing Activity; Abstract Only

We made computer simulations of orbital evolution for intervals of at least 5-10 Myr of N=2000 Jupiter-crossing objects (JCOs) with initial orbits close to those of real comets with period P less than 10 yr, 500 objects with orbits close to that of Comet 10P, and the asteroids initially located at the 3:1 and 5:2 resonances with Jupiter at initial eccentricity e(sub 0)=0.15 and initial inclination i(sub 0)=10(sup 0). The gravitational influence of all planets, except for Mercury and Pluto, was taken into account (without dissipative factors). We calculated the probabilities of collisions of bodies with the terrestrial planets, using orbital elements obtained with a step equal to 500 yr, and then summarized the results for all bodies, obtaining, the total probability Psigma of collisions with a planet and the total time interval Tsigma during which perihelion distance q of bodies was less than a semimajor axis of the planet. The values of p(sub r) =10(exp 6)Psigma/N and T(sub r)=T/1000 yr (where T=Tsigma/N) are presented in a table together with the ratio r of the total time interval when orbits were of Apollo type (at a greater than 1 AU, q less than 1.017 AU, e less than 0.999) to that of Amor type (1.017 less than q less than 1.33 AU), r(sub 2) is the same as r but for Apollo objects with e less than 0.9. For asteroids we present only results obtained by direct integration, as a symplectic method can give large errors for these resonances.
Derived from text
*Asteroids; Comets; Computerized Simulation; Orbital Elements; Terrestrial Planets; Jupiter (Planet)*

**20020066743** NASA Goddard Space Flight Center, Greenbelt, MD USA

**The Ejecta of Eta Carinae as Studied by STIS**

Gull, Theodore R., NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; Eta Carinae Conference/Workshop, 11-13 Jul. 2002, Mount Rainier, WA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The Space Telescope Imaging Spectrograph has been used to study the emission and absorption spectra of ejecta surrounding Eta Carinae. Discussion will be presented on the overall structure of the Homunculus, the Weigelt blobs and the Strontium filament. Three visits have been accomplished with the Position Angle precisely the same and covering the Central Source and Weigelt Blobs B and D. Deep spectra have been done at several positions to obtain the overall velocity structure of the Homunculus and the disk region. Mapping has been done with the STIS medium dispersion gratings set near H beta and H alpha. We have obtained full coverage of the strontium filament from 1640 Angstroms to 10300 Angstroms. The structure and physical properties will be described.

Author

*Ejecta; Imaging Techniques; Spectrographs; Absorption Spectra; Spaceborne Telescopes*

**20020066761** Smithsonian Astrophysical Observatory, Cambridge, MA USA

**Polarimeter for Low Energy X-ray Astrophysical Sources (PLEXAS)** ***Final Report, 11 Jan. 1999 - 10 Jan. 2002***

Murray, Stephen S., Smithsonian Astrophysical Observatory, USA; August 2002; 4p; In English

Contract(s)/Grant(s): NAG5-5219; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The Polarimeter for Low Energy X-ray Astrophysical Sources (PLEXAS) is an astrophysics mission concept for measuring the polarization of X-ray sources at low energies below the C-K band (less than 277 eV). PLEXAS uses the concept of variations in the reflectivity of a multilayered X-ray telescope as a function of the orientation of an X-rays polarization vector with respect to the reflecting surface of the optic. by selecting an appropriate multilayer, and rotating the X-ray telescope while pointing to a source, there will be a modulation in the source intensity, as measured at the focus of the telescope, which is proportional to the degree of polarization in the source.

Derived from text

*X Ray Telescopes; Polarimeters; Astronomical Polarimetry; Instrument Orientation; Polarization Modulation; Astrophysics*

**20020066774** NASA Goddard Space Flight Center, Greenbelt, MD USA

**Stellar Interferometry from the Ground and Space**

Danchi, William C., NASA Goddard Space Flight Center, USA; [2002]; 1p; In English, 6-25 Jun. 2002, Nice, France; Sponsored by Observatoire de la Cote d'Azur, France; No Copyright; Avail: Issuing Activity; Abstract Only

Stellar Interferometry began more than 80 years ago with the pioneering measurement of the diameter of Betelqueuse by Michelson and Pease using a 20 foot beam mounted at the top of the 10011 Hooker telescope at Mt. Wilson. Essentially no other work was done in this field until the 1960's when Hanbury-Brown and his colleagues developed and used the Intensity Interferometer at Narrabri, Australia to measure the diameters of a number of important hot stars. The modern period of Stellar Interferometry really began in the 1970's with the successes of 3 or 4 small research groups in the US and Europe, and scientific and technical progress in the field has been outstanding, particularly in the last decade. This has lead to the development of two major ground based facilities: NASA's own Keck Interferometer and ESO's Very Large Telescope Interferometer, and a number of space interferometers such as the Space Interferometer Mission (SIM), and the Terrestrial Planet Finder (TPF), among others. I will review the principles, history, and scientific progress in the field both on the ground and in space, and I will discuss a mission concept under development here at NASA Goddard, the Fourier-Kelvin Stellar Interferometer, a near-term mid-infrared imaging interferometer, which can serve as a scientific and technical pre-cursor for some of the more ambitious concepts being discussed within the Astronomical and NASA communities.

Author

*Astronomical Interferometry; Spaceborne Telescopes; Infrared Interferometers; Imaging Techniques; Ground Stations*

**20020066779** NASA Goddard Space Flight Center, Greenbelt, MD USA

**Deuterium Abundance Toward WD2211-495: Results from the Far Ultraviolet Spectroscopic Explorer (FUSE) Mission**

Hebrard, G., Institut d'Astrophysique, France; Lemoine, M., Institut d'Astrophysique, France; Vidal-Madjar, A., Institut d'Astrophysique, France; Desert, J. M., Institut d'Astrophysique, France; LecavelierdesEtangs, A., Institut d'Astrophysique, France; Ferlet, R., Institut d'Astrophysique, France; Wood, B. E., Colorado Univ., USA; Linsky, J. L., Colorado Univ., USA; Kruk, J. W., Johns Hopkins Univ., USA; Chayer, P., Johns Hopkins Univ., USA; [2002]; 40p; In English

Contract(s)/Grant(s): NAS5-32985; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present a deuterium abundance analysis of the line of sight toward the white dwarf WD 2211-495 observed with the Far Ultraviolet Spectroscopic Explorer (FUSE). Numerous interstellar lines are detected on the continuum of the stellar spectrum. A thorough analysis was performed through the simultaneous fit of interstellar absorption lines detected in the four FUSE channels of multiple observations with different slits. We excluded all saturated lines in order to reduce possible systematic errors on the column density measurements. We report the determination of the average interstellar D/O and D/N ratios along this line of sight at the 95% confidence level: D/O = 4.0 (+/-1.2) x 10(exp -2); D/N = 4.4 (+/-1.3) x 10(exp -1). In conjunction with FUSE observations of other nearby sight lines, the results of this study will allow a deeper understanding of the present-day abundance of deuterium in the local interstellar medium and its evolution with time.
Author
*Far UV Spectroscopic Explorer; Stellar Spectra; Continuous Spectra; Deuterium; Interstellar Matter; Density Measurement*

**20020066790** Smithsonian Astrophysical Observatory, Cambridge, MA USA
**Mineralogic and Petrologic Studies of Meteorites** ***Final Report, 1 Apr. 2001 - 31 Mar. 2002***
Wood, John, Smithsonian Astrophysical Observatory, USA; August 2002; 1p; In English
Contract(s)/Grant(s): NAG5-10455; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This report lists publications related to work done under NASA grant. Topics as indicated by title include: condensation in fractionated nebular systems, nebular processes in different constituents of the CH chondrite NWA 470, growth mechanism and additional constraints on FeNi metal condensation in the solar nebula, the ZONMET thermodynamic and kinetic model of metal condensation, the first occurrence of CaAl2O4 in a CAI (calcium aluminum inclusion) from the new CH chondrite NWA 470.
CASI
*Bibliographies; Solar Nebula; Chondrites*

**20020067407** NASA Marshall Space Flight Center, Huntsville, AL USA
**XTE J1908+094**
Woods, P. M., National Space Science and Technology Center, USA; Kouveliotou, C., National Space Science and Technology Center, USA; Finger, M. H., National Space Science and Technology Center, USA; Gogus, E., National Space Science and Technology Center, USA; Swank, J., NASA Goddard Space Flight Center, USA; Markwardt, C., NASA Goddard Space Flight Center, USA; Strohmayer, T., NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Goddard Space Flight Center reports the serendipitous discovery of a new x-ray transient, XTE J1908+094, in RXTE (Rossi X-ray Timing Explorer) PCA (Proportional Counter Array) observations of the soft-gamma-ray repeater SGR 1900+14, triggered following the burst activity on Feb. 17-18 (GCN 1253). These observations failed to detect the 5.2-s SGR pulsations, pointing towards a possible new source as the origin of the high x-ray flux. An RXTE PCA scan of the region around SGR 1900+14 on Feb. 21 was consistent with emission only from known sources (and no new sources). However, the scans required SGR 1900+14 to be 20 times brighter than its quiescent flux level (GCN 1256). A Director's Discretionary Time Chandra observation on Mar. 11 showed that the SGR was quiescent and did not reveal any new source within the Chandra ACIS (Advanced CCD (charge coupled device) Imaging Spectrometer) field-of-view. A subsequent RXTE PCA scan on Mar. 17, taken in combination with the first scan, required that a new source be included in the fit. The best-fit position is R.A. 19h 08m 50s, Decl. = +9 22 deg .5 (equinox J2000.0; estimated 2 deg systematic error radius), or approximately 24 deg away from the SGR source. The source spectrum (2-30 kev) can be best fit with a power-law function including photoelectric absorption (column density N_h = 2.3 x 10(exp 22), photon index = 1.55). Iron line emission is present, but may be due to the Galactic ridge. Between Feb. 19 and Mar. 17, the source flux (2-10 keV) has risen from 26 to 64 mCrab. The power spectrum is flat between 1 mHz and 0.1 Hz, falling approximately as 1/f**0.5 up to 1 Hz. At 1 Hz is seen a broad quasiperiodic oscillation peak and a break to a 1/f**2 power law, which continues to 4 Hz. The fractional rms (root mean square) amplitude from 1 mHz to 4 Hz is 43 percent. No coherent pulsations are seen between 0.001 and 1024 Hz. The authors conclude that XTE J1908+094 is a new blackhole candidate.
Author
*Gamma Ray Astronomy; Soft Gamma Repeaters; Black Holes (Astronomy); X Ray Astronomy*

**20020067410** NASA Marshall Space Flight Center, Huntsville, AL USA
**Micro-Meteoroids Effects on NGST Optics**
Cohen, Lester M., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 2nd Annual Technology Days, 22-24 May 2002, Huntsville, AL, USA
Contract(s)/Grant(s): NCC8-200; No Copyright; Avail: Issuing Activity; Abstract Only

Results from initial testing of micro-meteoroid testing and analysis will be shown. The micro-meteoroid environment at L2 encompasses particles whose size range from about 0.5micrometers to a few millimeters and whose velocities can and do exceed 20km/s. The particle flux ranges from about 2600/sq m/yr for 0.5um particles to 1 particle/sq m every 1700 yrs for 1 mm size particles. The major concern is not that the unprotected optics will be physically damaged; although if that did happen it would be a very localized effect. The real concern is that after many years, all of the particles that hit the optical and non-optical surfaces [after the 10 year lifetime of NGST, there may be one particle hit every 5mm] may cause the optics to deform, some of which may be uncorrectable. No previous study was found which looked at optic deformations. Many studies looked at reduced glass strength over time and in fact glass strength did fall greater than 25% in many cases. The reduction is strength can be attributed to the surface fractures caused by particle damage.
Author
*Micrometeoroids; Size Distribution; Deformation; Flux (Rate)*

**20020067444** NASA Marshall Space Flight Center, Huntsville, AL USA
**The Propagation and Formation of Electron Holes**
Coffey, Victoria, NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; Geospace Environment Modeling Workshop, 23-26 Jun. 2002, Telluride, CO, USA; No Copyright; Avail: Issuing Activity; Abstract Only

One of the striking findings of the International Solar Terrestrial Physics (ISTP) program is the detection of electron holes by several satellites in different regions of the magnetosphere, near the bow shock, and in the solar wind. These measurements have come from FAST (Fast Auroral Snapshot Explorer), Polar, Geotail, and Wind satellites. Using a 2-D (two dimensional) PIC (particle in cell) code we investigate the parameters of one and two electron beams on the evolution, structure, and stability of electron phase-space holes.
Author
*Holes (Electron Deficiencies); Solar Wind; Earth Magnetosphere*

## 91
## LUNAR AND PLANETARY SCIENCE AND EXPLORATION

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

**20020065445** NASA Ames Research Center, Moffett Field, CA USA
**A Kepler Mission, A Search for Habitable Planets: Concept, Capabilities and Strengths**
Koch, David, NASA Ames Research Center, USA; Borucki, William, NASA Ames Research Center, USA; Lissauer, Jack, NASA Ames Research Center, USA; Dunham, Edward, Lowell Observatory, USA; Jenkins, Jon, Search for Extraterrestrial Intelligence Inst., USA; [1998]; 1p; In English
Contract(s)/Grant(s): RTOP 344-37-01-02; No Copyright; Avail: Issuing Activity; Abstract Only

The detection of extrasolar terrestrial planets orbiting main-sequence stars is of great interest and importance. Current ground-based methods are only capable of detecting objects about the size or mass of Jupiter or larger. The technological challenges of direct imaging of Earth-size planets from space are expected to be resolved over the next twenty years. Spacebased photometry of planetary transits is currently the only viable method for detection of terrestrial planets (30-600 times less massive than Jupiter). The method searches the extended solar neighborhood, providing a statistically large sample and the detailed characteristics of each individual case. A robust concept has been developed and proposed as a Discovery-class mission. The concept, its capabilities and strengths are presented.
Author
*Spaceborne Telescopes; Extrasolar Planets; Imaging Techniques*

**20020065544** NASA Ames Research Center, Moffett Field, CA USA
**Mars Atmospheric Dynamics**
Haberle, Robert, NASA Ames Research Center, USA; [1998]; 1p; In English; Fifth Latin-American Conference on Space Geophysics, 3 - 7 Nov. 1998, San Jose, Costa Rica; Copyright; Avail: Issuing Activity; Abstract Only

The Martian atmosphere is dynamically similar to the Earth's. Its spin-axis rotation rate is only minutes longer than Earth's so the Coriolois force is nearly identical to Earth's. The inclination of its spin axis is also similar to Earth's giving it similarity in seasonal change. and the Martian atmosphere is nearly transparent to solar radiation (except during dust periods) such that it is heated primarily by upwelling infrared radiation from the surface. These characteristics make Mars an ideal laboratory for

studying the dynamics of rapidly rotating differentially heated atmospheres. This talk reviews what we have learned about Mars atmospheric dynamics and how if compares with Earth. The source of information to make such a comparison comes from observations and models. The former are sparse and that the latter have played a major role in shaping our thinking about the general circulation on Mars. However, the models need validation. Fortunately, the first two orbiters in NASA's Mars Surveyor Program have instrumentation to address many of the issues related to the general circulation and climate of Mars. The first, Mars Global Surveyor, is already at Mars gathering data. The second, the Mars 98 Orbiter to be launched later this year, carries a dedicated atmospheric sounder. Thus, much will be learned about Mars' atmosphere in the next few years.
Author
*Mars Atmosphere; Atmospheric Physics; Mars (Planet)*

**20020065552** NASA Ames Research Center, Moffett Field, CA USA
**Scientific Issues Addressed by the Kepler Mission**
Bourcki, W. J., NASA Ames Research Center, USA; Koch, D. G., NASA Ames Research Center, USA; Lissauer, J. J., NASA Ames Research Center, USA; Jenkins, J. M., Search for Extraterrestrial Intelligence Inst., USA; [1998]; 1p; In English; Division for Planetary Sciences Meeting, 11-16 Oct. 1998, Madison, WI, USA
Contract(s)/Grant(s): RTOP 406-05-01-01; Copyright; Avail: Issuing Activity; Abstract Only

The Kepler Mission uses a wide field-of-view telescope to photometrically monitor 100,000 main-sequence stars for evidence of planetary transits. Because of the large number of stars monitored and because the mission is designed with a precision (0.002%) sufficient to readily recognize Earth-size planets transiting solar-like stars, several hundred Earth-size planets should be found. Based on the the Dopper velocity observations that find 2% of the main-sequence stars have Jupiter-size planets in short-period orbits, the Kepler mission is also expected to detect about 2000 giant planets. Several questions about the association of planet types and stellar characteristics can be investigated. For example; Are small planets found when Jupiter-mass planets are also present in inner orbits? What is the frequency of small planets compared to Jupiter-mass planets? What is the frequency and distribution of planets intermediate in size and mass to that of Earth and Jupiter? What correlations exist between planet size, distribution, and frequency with the characteristics of the stars they orbit? A comparison between model predictions and observation should be a useful step in evolving better models of planetary system formation and help put the formation of our Solar System in perspective.
Author
*Space Missions; Field of View; Telescopes; Solar System; Planetary Systems; Main Sequence Stars; Gas Giant Planets; Planetary Evolution*

**20020065571** NASA Ames Research Center, Moffett Field, CA USA
**The Kepler Mission: Search for Habitable Planets**
Borucki, William, NASA Ames Research Center, USA; Likins, B., NASA Ames Research Center, USA; [1998]; 1p; In English
Contract(s)/Grant(s): RTOP 406-05-01-01; Copyright; Avail: Issuing Activity; Abstract Only

Detecting extrasolar terrestrial planets orbiting main-sequence stars is of great interest and importance. Current ground-based methods are only capable of detecting objects about the size or mass of Jupiter or larger. The difficulties encountered with direct imaging of Earth-size planets from space are expected to be resolved in the next twenty years. Spacebased photometry of planetary transits is currently the only viable method for detection of terrestrial planets (30-600 times less massive than Jupiter). This method searches the extended solar neighborhood, providing a statistically large sample and the detailed characteristics of each individual case. A robust concept has been developed and proposed as a Discovery-class mission. Its capabilities and strengths are presented.
Author
*Terrestrial Planets; Main Sequence Stars; Detection; Imaging Techniques*

**20020066264** NASA Ames Research Center, Moffett Field, CA USA
**Obtaining the Mass and Radius of Extra-Solar Giant Planets**
Castellano, Tim, NASA Ames Research Center, USA; [1998]; 1p; In English; Protostars and Planets Conference, 6-11 Jul. 1998, USA
Contract(s)/Grant(s): RTOP 344-37-01-02; Copyright; Avail: Issuing Activity; Abstract Only

The scientific utility and feasibility of detecting transits of the 9 known extrasolar planets is explored. A transit of a solar-like star by a Jupiter mass planet produces a 1% decrease in the amount of light received from the star. Transit observation will remove the ambiguity in the measurement of the planetary mass inherent in the radial velocity method and confirm the planet's existence. The 9 known planets have a 33% chance of producing at least one observable transit. Additional extrasolar planet detections from the radial velocity surveys will increase this probability to greater than 90%. The radius of the planet can be determined by the

fractional decrease in light received during transit. The mass and radius may distinguish rocky or gas giant planets from brown dwarfs. The probability of detection, the transit signal size and duration, and predictions of the transit times (including errors) are calculated for circular and elliptical orbits. Observational limits are investigated and it is shown that small telescopes and existing detectors are adequate enough to achieve the 0.1% photometry necessary to detect transits of the known extrasolar planets. Author

*Extrasolar Planets; Gas Giant Planets; Elliptical Orbits; Ambiguity; Circular Orbits*

**20020066789** NASA Goddard Space Flight Center, Greenbelt, MD USA

**Formation and Migration of Trans-Neptunian Objects**

Ipatov, S. I., NASA Goddard Space Flight Center, USA; [2002]; 1p; In English; Scientific Frontiers in Research of Extrasolar Planets, 18-21 Jun. 2002, Washington, DC, USA

Contract(s)/Grant(s): INTAS-00-240; RFBR-01-02-17540; NAG5-10776; No Copyright; Avail: Issuing Activity; Abstract Only

We consider that trans-Neptunian objects (TNOs) with diameter d greater than 100 kilometers moving now in not very eccentric orbits could be formed directly by the compression of large rarefied dust condensations (with a greater than 30 AU), but not by the accretion of smaller solid planetesimals. Probably, some planetesimals with d approximately 100- 1000 kilometers in the feeding zone of the giant planets and even large main-belt asteroids also could be formed directly by such compression. Some smaller objects (TNOs, planetesimals, asteroids) could be debris of larger objects, and other such objects could be formed directly by compression of condensations. A small portion of planetesimals from the feeding zone of the giant planets that entered into the trans-Neptunian region could left in eccentrical orbits beyond Neptune and became so called ”scattered objects”. Our computer runs in which gravitational interactions of bodies were taken into account with the use of the spheres method, showed that the embryos of Uranus and Neptune could increase their semimajor axes from less than 10 AU to their present values, moving permanently in orbits with small eccentricities, due to gravitational interactions with the migrating planetesimals. Later on, Thommes et al. considered a similar model using direct numerical integration. The total amount of water delivered to the Earth during the formation of the giant, planets was about the mass of water in the Earth oceans. The end of such bombardment could be caused mainly by the planetesimals that became scattered objects. For the present mass of the trans-Neptunian belt, the collisional lifetime of 1-kilometer TNO is about the age of the Solar system, but only a small portion (less than 1%) of 100-km TNOs could be destroyed during this age. The probability of destruction of a typical TNO (with 30 less than a,less than 50 AU) by scattered objects can be of the same order of magnitude as that by typical TNOs. TNOs could be even more often destroyed during planet formation than during last 4 Gyr. The analysis of the results of the orbital evolution of Jupiter-crossing objects (JCOs) and TNOs showed that, in principle, the trans-Neptunian belt can provide up to 100% of Earth-crossing objects, but, of course, some of them came from the main asteroid belt. Most of the collisions of former JCOs with the Earth were from orbits with aphelia inside Jupiter’s orbit and belonged to a small portion of objects which moved in such orbits for a long time. About 1 of 300 JCOs collided with the Sun. The ratio of the total mass of icy planetesimals that migrated from the feeding zone of the giant planets and collided with the planet to the mass of this planet was greater (by a factor of 3 in our runs) for Mars than that for Earth and Venus. Author

*Neptune (Planet); Planetary Evolution; Protoplanets; Solar System; Near Earth Objects*

## 92
## SOLAR PHYSICS

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

**20020066695** National Renewable Energy Lab., Golden, CO USA

**Deriving a Latitude-Optimized Pyranometer Calibration Factor**

Wilcox, S. M.; Myers, D. R.; Reda, I. M. A.; Mar. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-31910; NREL/CP-560-31910; No Copyright; Avail: National Technical Information Service (NTIS)

Work in recent years has produced improvements in determining the solar resource by better characterizing the responsivity of pyranometers. The calibration process can characterize a common responsivity dependency on the solar zenith angle, which can then be used to compensate for sensor variations during instrument deployment. However, daily compensation throughout the range of zenith angles might not be necessary for applications requiring only annual irradiance. This paper describes a method

of identifying a measurement bias due to latitude of deployment and optimizing an instrument's clear-sky responsivity for annual solar radiation measurements based on the relationship between solar zenith angles and the latitude.
NTIS
*Solar Radiation; Pyranometers; Solar Position; Calibrating*

**20020067402** NASA Marshall Space Flight Center, Huntsville, AL USA
**The Sun: Our Nearest Star**
Adams, M. L., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; AAVSO High Energy Astrophysics Workshop, 1-6 Jul. 2002, Waikoloa, HI, USA; No Copyright; Avail: Issuing Activity; Abstract Only

We have in our celestial backyard, a prime example of a variable star. The Sun, long thought to be "perfect" and unvarying, began to reveal its cycles in the early 1600s as Galileo Galilei and Christoph Scheiner used a telescope to study sunspots. For the past four hundred years, scientists have accumulated data, showing a magnetic cycle that repeats, on average, every eleven (or twenty-two) years. In addition, modern satellites have shown that the energy output at radio and x-ray wavelengths also varies with this cycle. This talk will showcase the Sun as a star and discuss how solar studies may be used to understand other stars.
Author
*Sun; Solar Activity; Stellar Physics; Stars*

**20020067576** NASA Marshall Space Flight Center, Huntsville, AL USA
**Forecasting Coronal Mass Ejections from Vector Magnetograms**
Falconer, D. A., NASA Marshall Space Flight Center, USA; Moore, R. L., NASA Marshall Space Flight Center, USA; Gary, G. A., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 200th Meeting of the American Astronomical Society, 2-6 Jun. 2002, Albuquerque, NM, USA; Sponsored by American Astronomical Society, USA; No Copyright; Avail: Issuing Activity; Abstract Only

In a 17 vector magnetogram study of 12 bipolar active regions (Falconer, Moore, & Gary, 2002, ApJ in press), we correlated four quantitative global magnetic measures with the Coronal Mass Ejections (CME) productivity of the active region. The global measures included a measure of active region size, the total magnetic flux phi and three measures of an active region global nonpotentiality 1) the net current (I (sub N)), 2) the length of the strong-shear, strong-field main neutral line (L(sub SS)) and 3) and the normalized twist (alpha = muIN/PHI). The CME productivity was determined from YOHKOH/SXT observations, Geostationary Operational Environmental Satellite (GOES), and when possible Solar and Heliospheric Observatory/Large Angle and Spectrometric Coronagraph Experiment (SOHO/LASCO) observations within 12 days of the day of the magnetogram. We found that the three measures of global nonpotentiality (I(sub N), L(sub SS), alpha) were all well correlated (greater than 99% confidence level) with an active region's CME productivity. The sample size was to small to confirm if there was a statistical significant correlation of the globally nonscientist measures with future CME activity (i.e. from the date of the magnetogram forward). We are doubling our sample, and will report on the statistical significance of global nonpotentiality as a predictor of future CME productivity. The new active regions are all from the first year of the upgraded MSFC vector magnetograms. This work, is funded by NSF through the Space Weather Program, by NASA through the Living with the Star, Targeted Research and Technology, and by NASA Solar Physics Supporting Research and Technology Program. The upgrade to the MSFC vector magnetograph was supported by the High Energy Solar Spectroscopic Imager (HESSI) mission.
Author
*Coronal Mass Ejection; Magnetic Signatures; Solar Physics; Space Weather; Statistical Analysis; Meteorological Satellites*

## 93
## SPACE RADIATION

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

**20020065290** Virginia Univ., Charlottesville, VA USA
**Implementation of the LHCb Level 0 Muon Trigger Using the 3D-Flow ASIC**
Corti, G.; Cox, B.; Crosetto, D.; Nelson, K.; Aug. 30, 1989; 18p; In English
Report No.(s): DE2002-762190; LHCB-98-001 TRIG/MUON; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The implementation of the LHCb Level 0 muon trigger using the 3D-F1ow technique is discussed. The connection of the LHCb Muon Detector front end electronics to the LO 3D-F1ow processor is also discussed.
NTIS
*Application Specific Integrated Circuits; Muons; Actuators*

**20020066513** NASA Marshall Space Flight Center, Huntsville, AL USA
**Gamma-Ray Bursts**
Meegan, Charles A., NASA Marshall Space Flight Center, USA; [2002]; 1p; In English; 91st Spring Meeting of the AAVSO, 30 Jun. - 6 Jul. 2002, Waikoloa Beach, HI, Waikoloa Beach, HI, USA, USA; Sponsored by NASA Marshall Space Flight Center, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Gamma-Ray Bursts (GRBs) are now known to be the most powerful explosions in the Universe. I will summarize the history of observations of GRBs, and how we came to know that the sources are so distant. I will also give an overview of the most prominent theories as to the cause of bursts.
Author
*Gamma Ray Bursts; Gamma Ray Astronomy*

**20020066523** Raytheon Technical Services Co., Lanham, MD USA
**Detection of the Near-IR Cosmic Infrared Background Using Alternative Models of Near-IR Galactic Emission in the DIRBE Data** ***Final Report, 3 Jan. - 31 Dec. 2000***
Arendt, Richard G., Raytheon Technical Services Co., USA; Dwek, Eli, NASA Goddard Space Flight Center, USA; Dec. 29, 2000; 19p; In English
Contract(s)/Grant(s): NASW-99228
Report No.(s): RTSC-3458; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The analysis portion of this task has been completed. New models were developed for the removal of the near-infrared emission of Galactic stars in the DIRBE data. Subtraction of these models from the observed emission attempted to achieve a better detection of the Cosmic Infrared Background at near-infrared wavelengths. The new models were found to provide a large improvement in the isotropy of the residual emission, however constraints on the intensity of the emission are not significantly improved. A paper detailing the procedures and results has been drafted, and will be completed next year. The draft of this paper is included as the final report on the contract.
Author
*Background Radiation; Stellar Radiation; Cosmic Rays; Infrared Astronomy*

**20020066526** NASA Goddard Space Flight Center, Greenbelt, MD USA
**X-Ray Spectral Variability Signatures of Flares in BL Lac Objects**
Boettcher, Markus, Rice Univ., USA; Chiang, James, NASA Goddard Space Flight Center, USA; [2002]; 38p; In English
Contract(s)/Grant(s): NAS9-10007; NAS8-39073; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We are presenting a detailed parameter study of the time-dependent electron injection and kinematics and the self-consistent radiation transport in jets of intermediate and low-frequency peaked BL Lac objects. Using a time-dependent, combined synchrotron-self-Compton and external-Compton jet model, we study the influence of variations of several essential model parameters, such as the electron injection compactness, the relative contribution of synchrotron to external soft photons to the soft photon compactness, the electron- injection spectral index, and the details of the time profiles of the electron injection episodes giving rise to flaring activity. In the analysis of our results, we focus on the expected X-ray spectral variability signatures in a region of parameter space particularly well suited to reproduce the broadband spectral energy distributions of intermediate and low-frequency peaked BL Lac objects. We demonstrate that SSC- and external-Compton dominated models for the gamma-ray emission from blazars are producing significantly different signatures in the X-ray variability, in particular in the soft X-ray light curves and the spectral hysteresis at soft X-ray energies, which can be used as a powerful diagnostic to unveil the nature of the high-energy emission from BL Lac objects.
Author
*BL Lacertae Objects; X Rays; Variability; Injection; Kinematics; Radiation Transport; Spectral Energy Distribution; Spectral Signatures*

**20020066736** NASA Goddard Space Flight Center, Greenbelt, MD USA

**Discovery of Cyclotron Resonance Features in the Soft Gamma Repeater SGR 1806-20**

Ibrahim, A. I., NASA Goddard Space Flight Center, USA; Safi-Harb, Samar, Manitoba Univ., Canada; Swank, Jean H., NASA Goddard Space Flight Center, USA; Parke, William, George Washington Univ., USA; Zane, Silvia, University Coll., UK; Turolla, Roberto, Padua Univ., Italy; [2002]; 6p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We report evidence for cyclotron resonance features from the Soft Gamma Repeater SCR 1806-20 in outburst, detected with the Rossi X-ray Timing Explorer in the spectrum of a long, complex precursor that preceded a strong burst. The features consist of a narrow 5.0 keV absorption line with modulation near its second and third harmonics (at 11.2 keV and 17.5 keV respectively). The line features are transient and are detected in the harder part of the precursor. The 5.0 keV feature is strong, with an equivalent width of approx. 500 eV, and a narrow width of is less than 0.4 keV. Interpreting the features as electron cyclotron lines in the context of accretion models leads to a large mass-radius ratio (M/R is greater than 0.3 Solar Mass/km) that is inconsistent with neutron stars, or requires a low (5 - 7) x 10(exp 11) G magnetic field that is unlikely for SGRs. The line widths are also narrow compared to those of electron cyclotron resonances observed so far in X-ray pulsars. In the magnetar picture, the features are plausibly explained as ion cyclotron resonances in an ultra-strong magnetic field, which have recently been predicted from magnetar candidates. In this view, the 5.0 keV feature is consistent with a proton cyclotron fundamental whose energy and width are close to model predictions. The line energy would correspond to a surface magnetic field of 1.0 x 10(exp 15) G for SGR 1806-20, in good agreement with that inferred from the spin-down measure in the source.
Author

*Ion Cyclotron Radiation; Repeaters; Gamma Rays; Cyclotron Resonance; Magnetic Fields; Astronomical Models*

**20020066742** NASA Goddard Space Flight Center, Greenbelt, MD USA

**The Multi-Component Nature of the Vela Pulsar Nonthermal X-ray Spectrum**

Harding, Alice K., NASA Goddard Space Flight Center, USA; Strickman, Mark S., Naval Research Lab., USA; Gwinn, Carl, California Univ., USA; McCulloch, P., Tasmania Univ., Australia; Moffet, D., Tasmania Univ., Australia; [2002]; 12p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We report on our analysis of a 274 ks observation of the Vela pulsar with the Rossi X-Ray Timing Explorer (RXTE). The double-peaked, pulsed emission at 2 - 30 keV, which we had previously detected during a 93 ks observation, is confirmed with much improved statistics. There is now clear evidence, both in the spectrum and the light curve, that the emission in the RXTE band is a blend of two separate non-thermal components. The spectrum of the harder component connects smoothly with the OSSE, COMPTEL and EGRET spectrum and the peaks in the light curve are in phase coincidence with those of the high-energy light curve. The spectrum of the softer component is consistent with an extrapolation to the pulsed optical flux, and the second RXTE pulse is in phase coincidence with the second optical peak. In addition, we see a peak in the 2-8 keV RXTE pulse profile at the radio phase.
Author

*X Ray Timing Explorer; Spectra; Gamma Ray Telescopes; Extrapolation; Light Curve*

**20020066766** NASA Marshall Space Flight Center, Huntsville, AL USA

**Soft X-Ray Emissions from Planets and Moons**

Bhardwaj, A., Indian Space Research Organization, India; Gladstone, G. R., Southwest Research Inst., USA; Elsner, R. F., NASA Marshall Space Flight Center, USA; Waite, J. H., Jr., Michigan Univ., USA; Grodent, D., Liege Univ., Belgium; Cravens, T. E., Kansas Univ., USA; Howell, R. R., Wyoming Univ., USA; Metzger, A. E., Jet Propulsion Lab., California Inst. of Tech., USA; Ostgaard, N., California Univ., USA; Maurellis, A., Space Research Organization Netherlands, Netherlands; [2002]; 10p; In English; ESLAB 36: ”Earth-like Planets and Moons” Conference, 3-8 Jun. 2002, Noordwijk, Netherlands; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A wide variety of solar system planetary bodies are now known to radiate in the soft x-ray energy (is less than 5 keV) regime. These include planets (Earth, Jupiter, Venus, Saturn): bodies having thick atmosphere and with/without intrinsic magnetic field; planetary satellites (Moon, Io, Europa, Ganymede): bodies with no/thin atmosphere; and comets and Io plasma torus: bodies having extended tenuous atmosphere. Several different mechanisms have been proposed to explain the generation of soft x-rays from these objects. whereas in the hard x-ray energy range (>10 keV) x-rays mainly result from electron bremsstrahlung process. In this paper we present a brief review of the x-ray observations on each of the planetary bodies and discuss their characteristics and proposed source mechanisms.
Author

*X Rays; Natural Satellites; Plasmas (Physics); Planets; Magnetic Fields*

**20020066775** NASA Goddard Space Flight Center, Greenbelt, MD USA

**Atomic Data and Spectral Line Intensities for Ne III**

Bhatia, A. K., NASA Goddard Space Flight Center, USA; Thomas, R. J., NASA Goddard Space Flight Center, USA; Landi, E., Naval Research Lab., USA; [2002]; 1p; In English; 3rd International Conference on Atomic and Molecular Data and their Applications, 24-27 Apr. 2002, Unknown; No Copyright; Avail: Issuing Activity; Abstract Only

A number of satellites and rockets have been launched to observe radiation from the Sun and other astrophysical objects. Line radiation is emitted when the electron impact excited levels decay to the lower levels by photon emission. From this radiation, the physical parameters such as electron temperature and density of the astrophysical plasma, elemental abundance, and opacity can be inferred. Ne III lines have been observed in H II regions, Ne-rich filaments in supernovae, and planetary nebulae. The allowed line at 489.50 Angstroms due to the transition 2s(sup 2) 2p(sup 5) (sup 3) P2 (goes to) 2s(sup 2)2p(sup 4)(sup 3)P2 has been identified in the solar spectrum by Vernazza and Reeves using Skylab observations. Other Ne III lines in the solar EUV spectrum have been reported by Thomas and Neupert based on observations from the Solar EUV Rocket Telescope and Spectrograph (SERTS) instrument. Atomic data for Ne III have been calculated by using a set of programs developed at, University College, London. The Superstructure and Distorted Wave (DW) programs have been updated over the years. In the Superstructure program, configuration interaction can be taken into account and radial functions are calculated in a modified Thomas-Fermi-Amaldi potential. This is a statistical potential and depends on parameters lambda 1 which are determined by optimizing the weighted sum of term energies. They are found to be lambda(sub 0)=1.2467, lambda(sub 1)=1.1617, and lambda(sub 2)=1.0663. The relativistic corrections are included by using the Breit-Pauli Hamiltonian as a perturbation to the nonrelativistic Hamiltonian. The same potential is used to calculate reactance matrices in the DW approximation in LS coupling. Collision strengths in intermediate coupling are obtained by using term coupling coefficients obtained from the Superstructure program. In this calculation, the configurations used are 2s(sup 2)2p(sup 4), 2s2p(sup 5), 2s(sup 2)2p(sup 3)3s, 2s(sup 2)p(sup 3)3d giving rise to 57 fine-structure levels in intermediate coupling.

Author

*H II Regions; Line Spectra; Astrophysics; Molecular Structure; Planetary Nebulae*

**20020066778** Massachusetts Inst. of Tech., Cambridge, MA USA

**New Energetic Radio Pulsars: An Archival X-Ray Survey** ***Final Report***

[2002]; 1p; In English

Contract(s)/Grant(s): NAG5-9120; No Copyright; Avail: Issuing Activity; Abstract Only

This ADP grant was to analyze archival X-ray data obtained in the direction of radio pulsars that were recently discovered as part of the Parkes Multibeam Pulsar Search, which was done using the 64-m Parkes radio telescope in Australia. The survey discovered nearly 700 pulsars, of which roughly three dozen were possible candidates for the detection of X-ray emission. Our team looked at 30 of the most interesting candidates. In most cases, there was insufficient data in the archive to conclude anything. However in several cases, there were interesting archival observations. In three cases, a detailed analysis proved scientifically interesting, and two publications have resulted.

Author

*X Rays; Data Acquisition; Pulsars*

**20020066780** Smithsonian Astrophysical Observatory, Cambridge, MA USA

**Hard X-Ray Emission of X-Ray Bursters** ***Final Report, 1 Mar. 2000 - 28 Feb. 2002***

Kaaret, P., Smithsonian Astrophysical Observatory, USA; July 2002; 1p; In English

Contract(s)/Grant(s): NAG5-9097; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The primary goal of this proposal was to increase our understanding of the accretion dynamics and emission mechanisms in neutron-star low-mass x-ray binaries via accurate measurements of their broad-band x-ray spectrum with particular emphasis on the hard x-ray emission. We obtained an extensive set of Rossi X-Ray Timing Explorer (RXTE) observations of a bright hard x-ray outburst from the source 4U1728-34 including data obtained under this proposal and previously scheduled observations for another observer. We have constructed x-ray light curves in several energy bands, including hard energy bands, from these data. We also completed spectral analysis of several observations which show strong hard x-ray emission. We are currently performing timing analysis to search for possible correlations between the spectral and timing evolution of 4U1728-34. Due to the one-year delay in obtaining the observations made for the other observer (which are the ones containing the peak of the hard X-ray emission), the analysis for this project is not yet complete. Because 4U1728-34 shows interesting high-frequency timing behavior, we plan to complete the analysis as part of our on-going investigation of high-frequency timing of X-ray binaries.

Author

*Neutron Stars; X Ray Binaries; X Ray Timing Explorer; Astrophysics*

**20020067400** NASA Goddard Space Flight Center, Greenbelt, MD USA

**A Gamma-Ray Burst Trigger Toolkit**

Band, David L., NASA Goddard Space Flight Center, USA; [2002]; 14p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The detection rate of a gamma-ray burst detector can be increased by using a count rate trigger with many accumulation times DELTAt and energy bands DELTAE Because a burst's peak flux varies when averaged over different DELTAt and DELTAE the nominal sensitivity (the numerical value of the peak flux) of a trigger system is less important than how much fainter a burst could be at the detection threshold as DELTAt and DELTAE are changed. The relative sensitivity of different triggers can be quantified by referencing the detection threshold back to the peak flux for a fiducial value of DELTAt and DELTA E. This mapping between peak flux values for different sets of DELTAt and DELTAE varies from burst to burst. Quantitative estimates of the burst detection rate for a given detector and trigger system can be based on the observed rate at a measured peak flux value in this fiducial trigger. Predictions of a proposed trigger's burst detection rate depend on the assumed burst population, and these predictions can be wildly in error for triggers that differ significantly from previous missions. I base the fiducial rate on the BATSE observations: 550 bursts per sky above a peak flux of 0.3 ph per square centimeter per second averaged over DELTAt=1.024 sec and DELTAE=50-300 keV. Using a sample of 100 burst lightcurves I find that triggering on any value of DELTAt that is a multiple of 0.064 sec decreases the average threshold peak flux on the 1.024 sec timescale by a factor of 0.6. Extending DELTAE to lower energies includes the large flux of the X-ray background, increasing the background count rate. Consequently a low energy DELTAE is advantageous only for very soft bursts. Whether a large fraction of the population of bright bursts is soft is disputed; the new population of X-ray Flashes is soft but relatively faint.

Author

*Gamma Ray Bursts; Gamma Ray Observatory; Detection; Background Radiation*

**20020067412** NASA Marshall Space Flight Center, Huntsville, AL USA

**Measurement of Arcminute Scale Cosmic Microwave Background Anisotropy with the BIMA Array**

Dawson, K. S., California Univ., USA; Holzapfel, W. L., California Univ., USA; Carlstrom, J. E., Chicago Univ., USA; Joy, M., NASA Marshall Space Flight Center, USA; LaRoque, S. J., Chicago Univ., USA; Miller, A., Chicago Univ., USA; Nagai, D., Chicago Univ., USA; [2002]; 1p; In English

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We report the results of our continued study of arcminute scale anisotropy in the Cosmic Microwave Background (CMB) with the Berkeley-Illinois-Maryland Association (BIMA) array. The survey consists of ten independent fields selected for low infrared dust emission and lack of bright radio point sources. With observations from the VLA (Very Large Array) at 4.8 GHz, we have identified point sources which could act as contaminants in estimates of the CMB power spectrum and removed them in the analysis. Modeling the observed power spectrum with a single. flat band power with average multipole of l(sub eff) = 6864, we find Delta T = 14.2((sup +4.8)(sub -6.0)) micro K at 68% confidence. The signal in the visibility data exceeds the expected contribution from instrumental noise with 96.5% confidence. We have also divided the data into two bins corresponding to different spatial resolutions in the power spectrum. We find Delta T(sub 1) = 16.6((sup +5.3)(sub -5.9)) micro K at 68% confidence for CMB flat band power described by an average multipole of l(sub eff) = 5237 and Delta T(sub 2) is less than 26.5 micro K at 95% confidence for l(sub eff) = 8748.

Author

*Anisotropy; Background Radiation; Point Sources; Cosmic Rays*

# Subject Term Index

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