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STAR

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National Aeronautics and
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Langley Research Center

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- Translations in report form;
- NASA-owned patents and patent applications
- Other U.S. Government agency and foreign patents and patent applications
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Also included are two indexes, Subject Term and Personal Author. The Subject Term Index is generated from the *NASA Thesaurus* terms associated and listed with each document.

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

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01 Aeronautics (General) 1

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

02 Aerodynamics 3

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

03 Air Transportation and Safety 7

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 13

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 13

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

07 Aircraft Propulsion and Power 20

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 21

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) 22

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).*

Subject Categories of the Division B. Astronautics

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12 Astronautics (General) 22

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*.

14 Ground Support Systems and Facilities (Space) 25

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

15 Launch Vehicles and Launch Operations 27

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

16 Space Transportation and Safety 27

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

17 Space Communications, Spacecraft Communications, Command and Tracking 35

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

18 Spacecraft Design, Testing and Performance 36

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and spacecraft control and stability characteristics. For life support systems, see *54 Man/System Technology and Life Support*. For related

information, see also *05 Aircraft Design, Testing and Performance*, *39 Structural Mechanics, and 16 Space Transportation and Safety.*

19 Spacecraft Instrumentation and Astrionics 38

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

20 Spacecraft Propulsion and Power 39

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

Subject Categories of the Division C. Chemistry and Materials

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

23 Chemistry and Materials (General) 43

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 44

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

25 Inorganic, Organic, and Physical Chemistry 46

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 48

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

27 Nonmetallic Materials 49

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

28 Propellants and Fuels 52

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

29 Space Processing 54

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

Subject Categories of the Division D. Engineering

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

31 Engineering (General) 57

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 58

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 78

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 81

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 83

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*.

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

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

43 Earth Resources and Remote Sensing 87

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 89

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 90

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

46 Geophysics 94

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 97

Includes weather observation forecasting and modification.

48 Oceanography 102

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

Subject Categories of the Division F. Life Sciences

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

51 Life Sciences (General) 103

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 107

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

53 Behavioral Sciences 117

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

54 Man/System Technology and Life Support 120

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

Subject Categories of the Division G. Mathematical and Computer Sciences

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

59 Mathematical and Computer Sciences (General) 123

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 124

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 124

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 130

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 132

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 133

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

65 Statistics and Probability 133

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

67 Theoretical Mathematics 134

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

Subject Categories of the Division H. Physics

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

71 Acoustics 135

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 140

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

74 Optics 141

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

75 Plasma Physics 141

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

76 Solid-State Physics 142

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

77 Physics of Elementary Particles and Fields 145

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

Subject Categories of the Division I. Social and Information Sciences

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

80 Social and Information Sciences (General) 146

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

81 Administration and Management 146

Includes management planning and research.

82 Documentation and Information Science 147

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

85 Technology Utilization and Surface Transportation 149

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.

Subject Categories of the Division J. Space Sciences

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

88 Space Sciences (General) 149

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

89 Astronomy 151

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

90 Astrophysics 153

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

91 Lunar and Planetary Science and Exploration 156

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 184

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

93 Space Radiation 185

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

Subject Categories of the Division K. General

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99 General 189

Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs such as Apollo, Gemini, and Mercury spacecraft, Earth Resources Technology Satellite (ERTS), and Skylab; NASA appropriations hearings.

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Typical Report Citation and Abstract

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

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SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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VOLUME 38, APRIL 7, 2000

01
AERONAUTICS (GENERAL)

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

20000025583 NASA Glenn Research Center, Cleveland, OH USA
LWC and Temperature Effects on Ice Accretion Formation on Swept Wings at Glaze Ice Conditions
Vargas, Mario, NASA Glenn Research Center, USA; Reshotko, Eli, Case Western Reserve Univ., USA; January 2000; 40p; In English; 38th; 38th Aerospace Sciences Meeting, 10-13 Jan. 2000, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations
Contract(s)/Grant(s): RTOP 548-20-23
Report No.(s): NASA/TM-2000-209777; NAS 1.15:209777; AIAA Paper 2000-0483; E-12059; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

An experiment was conducted to study the effect of liquid water content and temperature on the critical distance in ice accretion formation on swept wings at glaze ice conditions. The critical distance is defined as the distance from the attachment line to tile beginning of the zone where roughness elements develop into glaze ice feathers. A baseline case of 150 mph, 25 F, 0.75 g/cu m. Cloud Liquid Water Content (LWC) and 20 micrometers in Water Droplet Median Volume Diameter (MVD) was chosen. Icing runs were performed on a NACA 0012 swept wing tip at 150 mph and MVD of 20 micrometers for liquid water contents of 0.5 g/cu m, 0.75 g/cu m, and 1.0 g/cu m, and for total temperatures of 20 F, 25 F and 30 F. At each tunnel condition, the sweep angle was changed from 0 deg to 45 deg in 5 deg increments. Casting data, ice shape tracings, and close-up photographic data were obtained. The results showed that decreasing the LWC to 0.5 g/cu m decreases the value of the critical distance at a given sweep angle compared to the baseline case, and starts the formation of complete scallops at 30 sweep angle. Increasing the LWC to 1.0 g/cu m increases the value of the critical distance compared to the baseline case, the critical distance remains always above 0 millimeters and complete scallops are not formed. Decreasing the total temperature to 20 F decreases the critical distance with respect to the baseline case and formation of complete scallops begins at 25 deg sweep angle. When the total temperature is increased to 30 F, bumps covered with roughness elements appear on the ice accretion at 25 deg and 30 deg sweep angles, large ice structures appear at 35 deg and 40 deg sweep angles, and complete scallops are formed at 45 deg sweep angle.
Author
Ice Formation; Temperature Effects; Swept Wings; Glazes; Moisture Content; Deposition

20000025775 National Aerospace Lab., Tokyo Japan
Measurements of Unsteady Pressure Distributions and Dynamic Deformations on an SST Elastic Arrow-Wing Model
Tamayama, M.; Saitoh, K.; Matsushita, H.; Hashidate, M.; Nakamichi, J.; Jun. 1999; 18p; In Japanese; Portions of this document are not fully legible
Report No.(s): PB2000-102569; NAL-TR-1387T; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Unsteady pressure distributions were measured in a series of experiments in the transonic regime for a double-swept-back semi-span SST arrow wing model. The wing is an elastic model, the first natural frequency is 9.79 Hz. Forty-six unsteady pressure transducers and 45 pressure orifices were embedded at two semi-span stations to measure unsteady and steady pressure distributions respectively. The influence of temperature drifts in the wind tunnel could be effectively removed from the pressure transducer signal by timely taking of zero-balance. As a result, the gain of amplifiers was able to be raised, and then high S/N ratio achieved. Dynamic deformation data of the wing model were also measured, using optical targets and CCD cameras. The flow

field around the model was excited by a trailing edge flap which was oscillated around a mean deflection angle in the frequency range up to 30 Hz. The model vibration mode changed at the flap frequency near the model 1st resonance. The unsteady pressure distributions were affected by this change of vibration mode. Unsteady lift and moment coefficients were derived from unsteady pressure distributions. Of particular interest is the fact that while the unsteady aerodynamic coefficients were affected strongly by the flap motion at the inboard wing section, they were influenced by the wing vibration at the outboard wing section.
NTIS
Arrow Wings; Aeroelastic Research Wings; Deformation; Pressure Distribution; Pressure Gradients; Unsteady Aerodynamics; Unsteady Flow; Supersonic Transports

20000027414 Society of Experimental Test Pilots, Lancaster, CA USA
1999 Report to the Aerospace Profession: Forty Third Symposium Proceedings
September 1999; ISSN 0742-3705; 226p; In English; 43rd, 23-25 Sep. 1999, Beverly Hills, CA, USA; See also 20000027415 through 20000027429; Copyright; Avail: Issuing Activity

The objectives of the Society of Experimental Test Pilots (SETP) is to Promote air safety by presenting pilot's opinion; Strengthen the influence of the test pilot on aeronautical progress; Continuously evaluate the adequacy of flight equipment; Exchange information for the development of improved testing techniques; Exchange ideas, experiences, and information concerning techniques of escape and survival; Discuss newly experienced phenomena in the realm of flight; Further professional advancement through lectures and displays; Stimulate interest in aviation careers through scholarships and other projects among the youth of the world; and Broaden professional and fraternal relationships.
Derived from text
Conferences; Lectures; Papers; Reports

20000027499 NASA Ames Research Center, Moffett Field, CA USA
The History of the XV-15 Tilt Rotor Research Aircraft from Concept to Flight
Maisel, Martin D., NASA Ames Research Center, USA; Giulianetti, Demo J., NASA Ames Research Center, USA; Dugan, Daniel C., NASA Ames Research Center, USA; [2000]; 220p; In English
Report No.(s): NASA/SP-2000-4517; NAS 1.2l:4517; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

This monograph is a testament to the efforts of many people overcoming multiple technical challenges encountered while developing the XV-15 tilt rotor research aircraft. The Ames involvement with the tilt rotor aircraft began in 1957 with investigations of the performance and dynamic behavior of the Bell XV-3 tilt rotor aircraft. At that time, Ames Research Center was known as the Ames Aeronautical Laboratory of the National Advisory Committee for Aeronautics (NACA). As we approach the new millennium, and after more than 40 years of effort and the successful completion of our initial goals, it is appropriate to reflect on the technical accomplishments and consider the future applications of this unique aircraft class, the tilt rotor. The talented engineers, technicians, managers, and leaders at Ames have worked hard with their counterparts in the U.S. rotorcraft industry to overcome technology barriers and to make the military and civil tilt rotor aircraft safer, environmentally acceptable, and more efficient. The tilt rotor aircraft combines the advantages of vertical takeoff and landing capabilities, inherent to the helicopter, with the forward speed and range of a fixed wing turboprop airplane. Our studies have shown that this new vehicle type can provide the aviation transportation industry with the flexibility for highspeed, long-range flight, coupled with runway-independent operations, thus having a significant potential to relieve airport congestion. We see the tilt rotor aircraft as an element of the solution to this growing air transport problem.
Derived from text
XV-15 Aircraft; Tilt Rotor Research Aircraft Program; Civil Aviation; Aircraft Design; Wind Tunnel Tests

20000027501 NASA Langley Research Center, Hampton,VA USA
Aeronautical Engineering: A Continuing Bibliography With Indexes, Supplement 406
August 1999; 60p; In English
Report No.(s): NASA/SP-1999-7037/SUPPL406; NAS 1.21:7037/SUPPL406; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This supplemental issue of Aeronautical Engineering, A Continuing Bibliography with Indexes (NASA/SP-1999-7037) lists reports, articles, and other documents recently announced in the NASA STI Database. The coverage includes documents on the engineering and theoretical aspects of design, construction, evaluation, testing, operation, and performance of aircraft (including

aircraft engines) and associated components, equipment, and systems. It also includes research and development in aerodynamics, aeronautics, and ground support equipment for aeronautical vehicles. Each entry in the publication consists of a standard bibliographic citation accompanied, in most cases, by an abstract. Two indexes-subject and author are included after the abstract section.
CASI
Aerodynamics; Aeronautical Engineering; Bibliographies; Indexes (Documentation)

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.

20000025329 NASA Langley Research Center, Hampton, VA USA
Low-Speed Stability-and-Control and Ground-Effects Measurements on the Industry Reference High Speed Civil Transport
Kemmerly, Guy T., NASA Langley Research Center, USA; Campbell, Bryan A., NASA Langley Research Center, USA; Banks, Daniel W., NASA Langley Research Center, USA; Yaros, Steven F., NASA Langley Research Center, USA; December 1999; 188p; In English
Contract(s)/Grant(s): RTOP 537-03-22-02
Report No.(s): NASA/TM-1999-209702; NAS 1.15:209702; L-17920; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

As a part of a national effort to develop an economically feasible High Speed Civil Transport (HSCT), a single configuration has been accepted as the testing baseline by the organizations working in the High Speed Research (HSR) program. The configuration is based on a design developed by the Boeing Company and is referred to as the Reference H (Ref H). The data contained in this report are low-speed stability-and-control and ground-effect measurements obtained on a 0.06 scale model of the Ref H in a subsonic tunnel.
Author
Civil Aviation; High Speed; Subsonic Wind Tunnels; Ground Effect (Aerodynamics); Low Speed Stability; Control Surfaces

20000025330 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA USA
A Computational Model for Rotor-Fuselage Interactional Aerodynamics
Boyd, D. Douglas, Jr., Virginia Polytechnic Inst. and State Univ., USA; Barnwell, Richard W., Virginia Polytechnic Inst. and State Univ., USA; Gorton, Susan Althoff, Army Aviation and Missile Command, USA; 2000; 11p; In English; 38th; Aerospace Sciences, 10-13 Jan. 2000, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-0256; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

A novel unsteady rotor-fuselage interactional aerodynamics model has been developed. This model loosely couples a Generalized Dynamic Wake Theory (GDWT) to a thin-layer Navier-Stokes solution procedure. This coupling is achieved using an unsteady pressure jump boundary condition in the Navier-Stokes model. The new unsteady pressure jump boundary condition models each rotor blade as a moving pressure jump which travels around the rotor azimuth and is applied between two adjacent planes in a cylindrical, non-rotating grid. Comparisons are made between measured and predicted time-averaged and time-accurate rotor inflow ratios. Additional comparisons are made between measured and predicted unsteady surface pressures on the top centerline and sides of the fuselage.
Author
Interactional Aerodynamics; Rotor Aerodynamics; Fuselages

20000025331 NASA Langley Research Center, Hampton, VA USA
Unsteady Slat-Wake Characteristics of a High-Lift Configuration
Paschal, Keith, NASA Langley Research Center, USA; Jenkins, Luther, NASA Langley Research Center, USA; Yao, Chungsheng, NASA Langley Research Center, USA; [2000]; 12p; In English; 38th; 38th Aerospace Sciences Meeting, 10-13 Jan. 2000, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations
Report No.(s): AIAA Paper 2000-0139; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Unsteady characteristics of the slat wake associated with a three-element high-lift model were investigated with Particle Image Velocimetry (PIV). The test was conducted in the NASA Langley Basic Aerodynamic Research Tunnel (BART) employing sidewall blowing to maintain 2-D flow over the high-lift configuration. The main goal of the experiment was to document spatial characteristics of the unsteady slat wake in an effort to further guide computational efforts. PIV measurements were made at 4, 8, and 10 degrees angle of attack. Instantaneous vector maps revealed organized structures that had been ejected from the slat cove merging with the slat wake. This phenomenon is attributed to the unsteadiness of the recirculation region in the slat cove. The unsteadiness is most pronounced at 4 degrees. Mean data show a wide, diffuse wake at 4 degrees that becomes both narrow and well defined at 10 degrees angle of attack. Second-order statistics suggest a similar trend. These statistics show higher levels of fluctuations due to slat cove unsteadiness and turbulence at 4 degrees, while the slat cove flow has apparently stabilized at the higher angles of attack.
Author
Aerodynamic Configurations; Angle of Attack; Wakes; Wind Tunnel Tests; Airfoils; Two Dimensional Flow; Lift

20000025332 NASA Langley Research Center, Hampton, VA USA
Large Eddy Simulation of Wake Vortices in the Convective Boundary Layer
Lin, Yuh–Lang, North Carolina State Univ., USA; Han, Jongil, North Carolina State Univ., USA; Zhang, Jing, North Carolina State Univ., USA; Ding, Feng, North Carolina State Univ., USA; Arya, S. Pal, North Carolina State Univ., USA; Proctor, Fred H., NASA Langley Research Center, USA; [2000]; 9p; In English; 38th; 38th Aerospace Sciences Meeting, 10-13 Jan. 2000, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAS1-18925; NCC1-188
Report No.(s): AIAA Paper 2000-0753; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche
The behavior of wake vortices in a convective boundary layer is investigated using a validated large eddy simulation model. Our results show that the vortices are largely deformed due to strong turbulent eddy motion while a sinusoidal Crow instability develops. Vortex rising is found to be caused by the updrafts (thermals) during daytime convective conditions and increases with increasing nondimensional turbulence intensity eta. In the downdraft region of the convective boundary layer, vortex sinking is found to be accelerated proportional to increasing eta, with faster speed than that in an ideal line vortex pair in an inviscid fluid. Wake vortices are also shown to be laterally transported over a significant distance due to large turbulent eddy motion. On the other hand, the decay rate of the, vortices in the convective boundary layer that increases with increasing eta, is larger in the updraft region than in the downdraft region because of stronger turbulence in the updraft region.
Author
Boundary Layers; Convection; Inviscid Flow; Large Eddy Simulation; Vertical Air Currents; Vortices; Wakes; Convective Flow

20000025334 NASA Glenn Research Center, Cleveland, OH USA
Numerical Analysis of the Trailblazer Inlet Flowfield for Hypersonic Mach Numbers
Steffen, C. J., Jr., NASA Glenn Research Center, USA; DeBonis, J. R., NASA Glenn Research Center, USA; December 1999; 18p; In English; 38th; 38th Aerospace Sciences Meeting, 10-13 Jan. 2000, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 523-31-13
Report No.(s): NASA/TM-1999-209654; NAS 1.15:209654; AIAA Paper 2000-0889; E-12010; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche
A study of the Trailblazer vehicle inlet was conducted using the Global Air Sampling Program (GASP) code for flight Mach numbers ranging from 4-12. Both perfect gas and finite rate chemical analysis were performed with the intention of making detailed comparisons between the two results. Inlet performance was assessed using total pressure recovery and kinetic energy efficiency. These assessments were based upon a one-dimensional stream-thrust-average of the axisymmetric flowfield. Flow visualization utilized to examine the detailed shock structures internal to this mixed-compression inlet. Kinetic energy efficiency appeared to be the least sensitive to differences between the perfect gas and finite rate chemistry results. Total pressure recovery appeared to be the most sensitive discriminator between the perfect gas and finite rate chemistry results for flight Mach numbers above Mach 6. Adiabatic wall temperature was consistently overpredicted by the perfect gas model for flight Mach numbers above Mach 4. The predicted shock structures were noticeably different for Mach numbers from 6-12. At Mach 4, the perfect gas and finite rate chemistry models collapse to the same result.
Author
Flow Distribution; Numerical Analysis; Engine Inlets

20000025393 NASA Johnson Space Center, Houston, TX USA

Thermal Analysis of the X-38 Aft Fin During Re-Entry

Hong, Andrew E., NASA Johnson Space Center, USA; Ninth Thermal and Fluids Analysis Workshop Proceedings; November 1999, pp. 91-106; In English; See also 20000025387; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This document contains the details of the thermal analysis of the X-38 aft fin during re-entry. This analysis was performed in order to calculate temperature response of the aft fin components. This would be provided as input to a structural analysis and would also define the operating environment for the electromechanical actuator (EMA). The calculated structural temperature response would verify the performance of the thermal protection system (TPS). The geometric representation of the aft fin was derived from an I-DEAS finite element model that was used for structural analysis. The thermal mass network model was derived from the geometric representation.

Author

Thermal Analysis; X-38 Crew Return Vehicle; Reentry; Mathematical Models; Applications Programs (Computers)

20000025454 NASA Langley Research Center, Hampton, VA USA

Subsonic Aerodynamic Assessment of Vortex Flow Management Devices on a High-Speed Civil Transport Configuration

Campbell, Bryan A., NASA Langley Research Center, USA; Applin, Zachary T., NASA Langley Research Center, USA; Kemmerly, Guy T., NASA Langley Research Center, USA; December 1999; 112p; In English

Contract(s)/Grant(s): RTOP 537-03-22-02

Report No.(s): NASA/TP-1999-209693; L-17147; NAS 1.60:209693; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

An experimental investigation of the effects of leading-edge vortex management devices on the subsonic performance of a high-speed civil transport (HSCT) configuration was conducted in the Langley 14- by 22-Foot Subsonic Tunnel. Data were obtained over a Mach number range of 0.14 to 0.27, with corresponding chord Reynolds numbers of 3.08 x 10 (sup 6) to 5.47 x 10 (sup 6). The test model was designed for a cruise Mach number of 2.7. During the subsonic high-lift phase of flight, vortical flow dominates the upper surface flow structure, and during vortex breakdown, this flow causes adverse pitch-up and a reduction of usable lift. The experimental results showed that the beneficial effects of small leading-edge vortex management devices located near the model reference center were insufficient to substantially affect the resulting aerodynamic forces and moments. However, devices located at or near the wiring apex region demonstrated potential for pitch control with little effect on overall lift.

Author

Subsonic Wind Tunnels; High Speed; Civil Aviation; Supersonic Transports; Aerodynamic Characteristics; Vortices; Flow Distribution

20000025500 NASA Langley Research Center, Hampton, VA USA

Serrated-Planform Lifting-Surfaces

McGrath, Brian E., Inventor, NASA Langley Research Center, USA; Wood, Richard M., Inventor, NASA Langley Research Center, USA; May 11, 1999; In English

Patent Info.: Filed 22 Oct. 1996; NASA-Case-LAR-15295-1; US-Patent-5,901,925; US-Patent-Appl-SN-734820; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

A novel set of serrated-planform lifting surfaces produce unexpectedly high lift coefficients at moderate to high angles-of-attack. Each serration, or tooth, is designed to shed a vortex. The interaction of the vortices greatly enhances the lifting capability over an extremely large operating range. Variations of the invention use serrated-planform lifting surfaces in planes different than that of a primary lifting surface. In an alternate embodiment, the individual teeth are controllably retractable and deployable to provide for active control of the vortex system and hence lift coefficient. Differential lift on multiple serrated-planform lifting surfaces provides a means for vehicle control. The important aerodynamic advantages of the serrated-planform lifting surfaces are not limited to aircraft applications but can be used to establish desirable performance characteristics for missiles, land vehicles, and/or watercraft.

Official Gazette of the U.S. Patent and Trademark Office

Aerodynamic Coefficients; Angle of Attack; Planforms; Vortex Shedding; Lifting Bodies

20000025535 NASA Langley Research Center, Hampton, VA USA

A Factorial Data Rate and Dwell Time Experiment in the National Transonic Facility

DeLoach, R., NASA Langley Research Center, USA; 2000; 16p; In English; 38th; Aerospace Sciences, 2000, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2000-0828; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report is an introductory tutorial on the application of formal experiment design methods to wind tunnel testing, for the benefit of aeronautical engineers with little formal experiment design training. It also describes the results of a Study to determine whether increases in the sample rate and dwell time of the National Transonic Facility data system would result in significant changes in force and moment data. Increases in sample rate from 10 samples per second to 50 samples per second were examined, as were changes in dwell time from one second per data point to two seconds. These changes were examined for a representative aircraft model in a range of tunnel operating conditions defined by angles of attack from 0 deg to 3.8 deg, total pressure from 15.0 psi to 24.1 psi, and Mach numbers from 0.52 to 0.82. No statistically significant effect was associated with the change in sample rate. The change in dwell time from one second to two seconds affected axial force measurements, and to a lesser degree normal force measurements. This dwell effect comprises a ”rectification error” caused by incomplete cancellation of the positive and negative elements of certain low frequency dynamic components that are not rejected by the one-Hz low-pass filters of the data system. These low frequency effects may be due to tunnel circuit phenomena and other sources. The magnitude of the dwell effect depends on dynamic pressure, with angle of attack and Mach number influencing the strength of this dependence. An analysis is presented which suggests that the magnitude of the rectification error depends on the ratio of measurement dwell time to the period of the low-frequency dynamics, as well as the amplitude of the dynamics. The essential conclusion of this analysis is that extending the dwell time (or, equivalently, replicating short-dwell data points) reduces the rectification error.

Author

Dwell; Time Dependence; Wind Tunnel Tests; Transonic Wind Tunnels; Rates (Per Time); Experiment Design; Aircraft Models

20000025555 Duke Univ., Dept. of Mechanical Engineering and Materials Science, Durham, NC USA

Reduced-Order Aerodynamic Model and Its Application to a Nonlinear Aeroelastic System

Tang, Deman, Duke Univ., USA; Conner, Mark D., Duke Univ., USA; Dowell, Earl H., Duke Univ., USA; Journal of Aircraft; March-April 1998; Volume 35, No. 2, pp. 332-338; In English

Contract(s)/Grant(s): F49620-97-1-0063; NAG1-1569; Copyright; Avail: Issuing Activity

Starting from a finite state model for a two-dimensional aerodynamic flow over an airfoil, the eigenmodes of the aerodynamic flow are determined. Using a small number of these aerodynamic eigenmodes, ie., a reduced-order model, the aeroelastic model is formed by coupling them to a typical section structural model with a trailing-edge flap. A free-play nonlinearity is modeled. Results are shown from the finite state model, the reduced-order model, and previous theoretical and experimental work. All results are in good agreement.

Author

Aeroelasticity; Mathematical Models; Aerodynamic Characteristics; Nonlinear Systems; Dynamic Models

20000025556 Duke Univ., Dept. of Mechanical Engineering and Materials Science, Durham, NC USA

Nonlinear Behavior of a Typical Airfoil Section with Control Surface Freeplay: A Numerical and Experimental Study

Conner, M. D., Duke Univ., USA; Tang, D. M., Duke Univ., USA; Dowell, E. H., Duke Univ., USA; Virgin, L. N., Duke Univ., USA; Journal of Fluids and Structures; 1997; ISSN 0889-9746; Volume 11, pp. 89-109; In English; Copyright; Avail: Issuing Activity

A three degree-of-freedom aeroelastic typical section with control surface freeplay is modeled theoretically as a system of piecewise linear state-space models. The system response is determined by time marching of the governing equations using a standard Runge-Kutta algorithm in conjunction with Henon’s method for integrating a system of equations to a prescribed surface of phase space section. Henon’s method is used to locate the ”switching points” accurately and efficiently as the system moves from one linear region into another. An experimental model which closely approximates the three degree-of-freedom, typical section in two-dimensional, incompressible flow has been created to validate the theoretical model. Consideration is given to modeling realistically the structural damping present in the experimental system. The effect of the freeplay on the system response is examined numerically and experimentally. The development of the state-space model offers a low-order, computationally efficient means of modeling fully the freeplay nonlinearity and may offer advantages in future research which will investigate the effects of freeplay on the control of flutter in the typical section.

Author

Airfoil Profiles; Control Surfaces; Dynamic Structural Analysis; Aircraft Structures

20000027440 NASA Langley Research Center, Hampton, VA USA

High-Speed Research: 1994 Sonic Boom Workshop. Configuration, Design, Analysis and Testing

McCurdy, David A., Editor, NASA Langley Research Center, USA; December 1999; 306p; In English; 3rd, 1-3 Jun. 1994, Hampton, VA, USA; Sponsored by NASA, USA; See also 20000027441 through 20000027455

Contract(s)/Grant(s): RTOP 537-03-21-03
Report No.(s): NASA/CP-1999-209699; L-17435; NAS 1.55:209699; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche

The third High-Speed Research Sonic Boom Workshop was held at NASA Langley Research Center on June 1-3, 1994. The purpose of this workshop was to provide a forum for Government, industry, and university participants to present and discuss progress in their research. The workshop was organized into sessions dealing with atmospheric propagation; acceptability studies; and configuration design, and testing. Attendance at the workshop was by invitation only. The workshop proceedings include papers on design, analysis, and testing of low-boom high-speed civil transport configurations and experimental techniques for measuring sonic booms. Significant progress is noted in these areas in the time since the previous workshop a year earlier. The papers include preliminary results of sonic boom wind tunnel tests conducted during 1993 and 1994 on several low-boom designs. Results of a mission performance analysis of all low-boom designs are also included. Two experimental methods for measuring near-field signatures of airplanes in flight are reported.
Author
Sonic Booms; Conferences; Supersonic Flight; Aircraft Configurations

20000027444 NASA Langley Research Center, Hampton, VA USA
Wind-Tunnel Overpressure Signatures From a Low-Boom HSCT Concept With Aft-Fuselage-Mounted Engines
Mack, Robert J., NASA Langley Research Center, USA; High-Speed Research: 1994 Sonic Boom Workshop. Configuration, Design, Analysis and Testing; December 1999, pp. 59-71; In English; See also 20000027440; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

A 1:300 scale wind-tunnel model of a conceptual High-Speed Civil Transport (HSCT) designed to generate a shaped, low-boom pressure signature on the ground was tested to obtain sonic-boom pressure signatures in the Langley Research Center Unitary Plan Wind Tunnel at a Mach number of 1.8 and a separation distance of about two body lengths or four wing-spans from the model. Two sets of engine nacelles representing two levels of engine technology were used on the model to determine the effects of increased nacelle volume. Pressure signatures were measured for (model lift)/(design lift) ratios of 0.5, 0.63, 0.75, and 1.0 so that the effect of lift on the pressure signature could be determined. The results of these tests were analyzed and used to discuss the agreement between experimental data and design expectations.
Author
Sonic Booms; Supersonic Transports; Separated Flow; Scale Models; Nacelles; Pressure Distribution; Boundary Layer Separation; Aircraft Configurations

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.

20000025347 Army Safety Center, Fort Rucker, AL USA
FLIGHTFAX: Army Aviation Risk-Management Information. Volume 27, Number 12. Improving Aviation Safety Performance
Dec. 1999; 12p; In English
Report No.(s): AD-A372187; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

As an Army we are involved in missions around the world and doing a lot of things without the experience base we once enjoyed. This lack of experience, continuous deployments, and not having the discipline to maintain and enforce standards are basic causes of accidental losses. Some of us wearing wings are not executing fundamental tasks, those taught to us in flight school, to standard. Analysis of major FY99 aviation accidents reveals that most of the accidents didn't happen at the time of impact or during the crash sequence; they really occurred much earlier with a breakdown in leadership, standards or discipline. In fact, FY99 produced Army aviation's worst safety performance since Desert Shield/Desert Storm. With 18 Class A aviation flight accidents and 20 fatalities, the upward trend in accidents that began in FY98 continued to climb. When leaders fail to enforce established standards, the natural result is accidents-and accidents cost. They cost lives, they cost time, and they cost equipment: a total cost of more than $ 139 million for aviation in FY99. The bottom line: soldiers are dying and we are destroying costly equipment at

a rate that is unacceptable. Leaders who understand and accept responsibility will help solve this Army-wide problem. Effective leaders will make sure soldiers know what the standards are and will ensure the standards are enforced.
DTIC
Aircraft Accidents; Aircraft Safety; Flight Safety; Risk; Management Information Systems; Costs

20000025486 NASA Langley Research Center, Hampton, VA USA
Design of an Aircraft Vortex Spacing System for Airport Capacity Improvement
Hinton, David A., NASA Langley Research Center, USA; Charnock, James K., NASA Langley Research Center, USA; Bagwell, Donald R., NASA Langley Research Center, USA; [2000]; 19p; In English; 38th; 38th Aerospace Sciences Meeting, 10-13 Jan. 2000, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-0622; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

The National Aeronautics and Space Administration (NASA) is addressing airport capacity enhancements through the Terminal Area Productivity (TAP) program. Within TAP, the Reduced Spacing Operations element at the NASA Langley Research Center is developing an Aircraft VOrtex Spacing System (AVOSS). AVOSS will integrate the output of several systems to produce weather dependent, dynamic wake vortex spacing criteria. These systems provide current and predicted weather conditions, models of wake vortex transport and decay in these weather conditions, and real-time feedback of wake vortex behavior from sensors. The goal of the NASA program is to provide the research and development to demonstrate an engineering model AVOSS, in real-time operation, at a major airport. A wake vortex system test facility was established at the Dallas-Fort Worth International Airport (DFW) in 1997 and tested in 1998. Results from operation of the initial AVOSS system, plus advances in wake vortex prediction and near-term weather forecast models, ”nowcast”, have been integrated into a second-generation system. This AVOSS version is undergoing final checkout in preparation for a system demonstration in 2000. This paper describes the revised AVOSS system architecture, subsystem enhancements, and initial results with AVOSS version 2 from a deployment at DFW in the fall of 1999.
Author
Airports; Vortices; Air Transportation; Aircraft Approach Spacing

20000025553 Massachusetts Inst. of Tech., Lincoln Lab., Lexington, MA USA
Lincoln Laboratory Evaluation of TCAS 2 Logic, Volume 1, Version 7
Chludzinzki, Barbara J.; Dec. 13, 1999; 75p; In English
Report No.(s): AD-A372379; ATC-268-Vol-1; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report documents the Lincoln Laboratory evaluation of the Traffic Alert and Collision Avoidance System II (TCAS II) logic version 7. TCAS II is an airborne collision avoidance system required since 30 December 1993 by the FAA on all air carrier aircraft with more than 30 passenger seats operating in the U.S. airspace. Version 7 is a major revision to the TCAS II logic consisting of more than 300 separately defined changes affecting all major TCAS areas (surveillance, CAS logic and displays/aurals). Lincoln Laboratory evaluated the logic by examining approximately two million simulated pairwise TCAS-TCAS encounters, derived from actual tracks recorded in U.S. airspace. The main goals of the evaluation were: (1) to study the performance of the new TCAS-TCAS coordinated reversal logic; (2) to detect and explain any areas of poor performance; (3) to examine the performance of the version 7 logic for the 30 Representative NMACs identified during the 6.04a logic evaluation; and (4) to understand the limitations of the logic by analyzing every version 7 NMAC. Five Lincoln Laboratory analysis programs written for previous logic evaluation work were updated and new software was written to aid in the evaluation of TCAS-TCAS sense reversals. There were four phases of the evaluation corresponding to the above goals. For each phase the report gives an overview of the evaluation approach taken and a description of the results. An overall summary and perspective on the evolution of the TCAS II logic are given at the end of the report.
DTIC
Collision Avoidance; Air Traffic Control; Airspace; Warning Systems; Accident Prevention; Civil Aviation

20000025778 National Aerospace Lab., Tokyo Japan
Simulation Tool for Analysing Crew Behavior. Part 1. Actions and Procedural Tasks
Muraoka, K.; Jun. 1999; 20p; In Japanese; Original contains color illustrations
Report No.(s): PB2000-102566; NAL-TR-1386; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper deals with an attempt to develop a crew behavioral model in an automated cockpit for use as an analytical engineering tool for issues including flight crew human factors. The model enables simulation of both physical and cognitive characteristics of human pilots. For the initial phase of development, a crew behavioral model with the ability to simulate actions and perform normal procedures was constructed in addition to the operational environment structure. The model was applied to

reconstruction of an accident and simulation of an approach flight under normal procedures. Simulation results demonstrated that the model is able to provide a sequence of pilot behavior as a three-dimensional animation, with additional information such as cockpit verbal communication and flight status, in addition to the feasibility of the tool providing analysis of flight crew human factors.
NTIS
Flight Crews; Human Factors Engineering; Human-Computer Interface; Cockpit Simulators; Simulation

20000025798 Alabama Univ., Dept. of Aerospace Engineering and Mechanics, Tuscaloosa, AL USA
In-Flight Advisor, Phase 1 ***Final Report***
Bass, Ellen, Alabama Univ., USA; Gainer, CHarles, Alabama Univ., USA; Katz, Ammon, Alabama Univ., USA; McInerny, Sally, Alabama Univ., USA; Merritt, Wayne T., Alabama Univ., USA; Dec. 1999; 82p; In English
Report No.(s): AD-A372523; DOT/FAA/AR-99/67; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy
This report is the result of a feasibility study to assess the use of artificial intelligence (AI) in alerting the crew of potential emergency situations before they actually occur. The objectives of the project are to specifically determine the feasibility of applying AI methodologies to reduce information overload on the pilot, to monitor data from selected components of an aircraft in flight, to inform the pilot of potentially critical events occurring or materializing, and to advise the pilot of specific actions to be taken in order to delay or avoid potential mishaps.
DTIC
Artificial Intelligence; Expert Systems; Pilot Support Systems; In-Flight Monitoring

20000026820 National Transportation Safety Board, Washington, DC USA
National Transportation Safety Board Transportation Initial Decisions and Orders and Board Opinions and Orders Adopted and Issued during the Month of November 1999
Nov. 1999; 278p
Report No.(s): PB99-916711; NTSB/IDBOO-99/11; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche
This publication contains all Judge Initial Decisions and Board and Board Opinions and Orders in Safety and Seaman Enforcement Cases for November 1999.
NTIS
Air Transportation; Accident Prevention; Safety Management

20000026843 Civil Aeromedical Inst., Civil Aeromedical Inst., Oklahoma City, OK USA
Prevalence of Chlorpheniramine in Aviation Accident Pilot Fatalities, 1991-1996
Soper, John W., Civil Aeromedical Inst., USA; Chaturvedi, Arvind K., Civil Aeromedical Inst., USA; Canfield, Dennis V., Civil Aeromedical Inst., USA; Dec. 1999; 8p; In English
Contract(s)/Grant(s): AM-B-97-TOX-202
Report No.(s): AD-A372538; DOT/FAA/AM-99/29; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
Chlorpheniramine, a popular nonprescription antihistaminic, is known to cause drowsiness. This side effect has a potential to impair performance and to be a factor in accidents. Therefore, this study was conducted to establish the prevalence of this drug in pilot fatalities of aviation accidents. During fatal aircraft accident investigations, postmortem samples collected from the pilots at autopsy are submitted to the Civil Aeromedical Institute for toxicological evaluation, and the findings are maintained in a database. Those data were examined for the presence of chlorpheniramine in the fatalities, which occurred during a 6-year (1991-1996) period. It was determined that there were 47 (2.2%) accidents involving chlorpheniramine. In 16 of these cases, only chlorpheniramine was found, with the mean concentrations of 109 ngml (n = 4) in blood and 1412 ng/g (n = 12) in liver. Other drugs were also present in the remaining 31 cases, wherein the mean chlorpheniramine concentrations were 93 ng/ml (n = 18) in blood and 747 ng/g (n = 12) in liver. Ninety-five percent of all the quantitative blood values were at or above the therapeutic (10 ng/ml) level, giving a 100 ng/ml (n = 21) blood mean level. The drug's mean concentration in the liver of all the cases was 1080 ng/g (n = 24). The average chlorpheniramine blood value was approximately 10 times higher than its therapeutic value. The presence of other drugs did not appear to significantly alter the blood level of chlorpheniramine, but no such correlation could be established with the hepatic value. The approximate 10-fold increase in the liver concentration, as compared with the blood value, was consistent with the general trend of the distribution of drugs in the hepatic compartment. However, the contribution of postmortem redistribution of the drug to alter its concentration cannot be entirely ruled out.
DTIC
Aerospace Medicine; Aircraft Accidents; Pharmacology; Toxicology; Aircraft Pilots

20000026844 National Transportation Safety Board, Washington, DC USA
Safety Recommendation
Jul. 13, 1999; 5p; In English
Report No.(s): AD-A372568; No Copyright; Avail: CASI; A01, Microfiche; A01, Hardcopy

On October 15, 1998, Delta Air Lines flight 915, a McDonnell Douglas MD-88, N902DE, experienced an uncontained failure in the No. 2 (right) engine, a Pratt & Whitney (P&W) JT8D-219, immediately after takeoff from Logan International Airport, Boston, Massachusetts. The pilots reported that, just after takeoff they felt a light thump, the airplane yawed to the right, and the cockpit instrumentation indicated that the No. 2 engine had lost power. The pilots then declared an emergency and returned to Boston. None of the 128 passengers, 4 flight attendants, and 2 pilots on board were injured. The airplane was operating on an instrument flight rules flight plan under the provisions of 14 Code of Federal Regulations Part 121 as a regularly scheduled passenger flight from Boston to Atlanta, Georgia.
DTIC
Aircraft Accident Investigation; Instrument Flight Rules; Failure; Flight Safety; Commercial Aircraft

20000026845 National Transportation Safety Board, Washington, DC USA
Safety Recommendation
Hall, Jim, National Transportation Safety Board, USA; Sep. 09, 1999; 4p; In English
Report No.(s): AD-A372583; No Copyright; Avail: CASI; A01, Microfiche; A01, Hardcopy

On February 6, 1999, at 0336 central standard time, Federal Express flight 1020 (FDX1020), a McDonnell-Douglas DC-10F, and Air Canada flight 754 (ACA754), an Airbus A320, were involved in a near midair collision approximately 40 miles north of Lincoln, Nebraska. While ACA754 was in cruise at flight level 350 (approximately 35,000 feet above sea level), the pilot received a Traffic Alert and Collision Avoidance System (TCAS)1 traffic advisory (TA) about FDX1020 then a resolution advisory (RA), directing the flight crew to climb to avoid a potential collision. The two aircraft subsequently passed within one mile. horizontally and 600 feet vertically. FDX1020 was not equipped with TCAS nor was it required. The flight crew of FDXl020 reported that it had not received any TAs from air traffic control (ATC) and had not been notified that proper separation had not been maintained. Neither aircraft was damaged, and no injuries were reported. Visual meteorological conditions (VMC) prevailed at the time of the incident. Both flights were operating under 14 Code of Federal Regulations (CFR) Part 121 on instrument flight plans.
DTIC
Aircraft Accidents; Collision Avoidance; Midair Collisions; Flight Safety; Accident Prevention; Aircraft Hazards

20000026847 National Transportation Safety Board, Washington, DC USA
Safety Recommendation
Jun. 01, 1999; 13p; In English
Report No.(s): AD-A372586; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

During the 1980s, the National Transportation Safety Board investigated several accidents that involved operator fatigue. Following completion of these accident investigations, the Safety Board in 1989 issued three recommendations to the U.S. Department of Transportation (DOT): Expedite a coordinated research program on the effects of fatigue, sleepiness, sleep disorders, and circadian factors on transportation system safety, (I-89-1). Develop and disseminate educational material for transportation industry personnel and management regarding shift work; work and rest schedules; and proper regimens of health, diet, and rest, (I-89-2). Review and upgrade regulations governing hours of service for all transportation modes to assure that they are consistent and that they incorporate the results of the latest research on fatigue and sleep issues (I-89-3).
DTIC
Accident Investigation; Circadian Rhythms; Transportation; Sleep; Operators (Personnel)

20000026848 National Transportation Safety Board, Washington, DC USA
Safety Recommendation
Jun. 01, 1999; 12p; In English
Report No.(s): AD-A372587; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

During the 1980s, the National Transportation Safety Board investigated several accidents that involved operator fatigue. Following completion of these accident investigations, the Safety Board in 1989 issued three recommendations to the U.S. Department of Transportation (DOT): Expedite a coordinated research program on the effects of fatigue, sleepiness, sleep disorders, and circadian factors on transportation system safety, (I-89-1). Develop and disseminate educational material for transportation industry personnel and management regarding shift work; work and rest schedules; and proper regimens of health,

diet, and rest, (I-89-2). Review and upgrade regulations governing hours of service for all transportation modes to assure that they are consistent and that they incorporate the results of the latest research on fatigue and sleep issues (I-89-3).
DTIC
Accident Investigation; Circadian Rhythms; Transportation; Sleep; Operators (Personnel)

20000026849 National Transportation Safety Board, Washington, DC USA
Safety Recommendation
Hall, Jim, National Transportation Safety Board, USA; Jun. 08, 1999; 3p; In English
Report No.(s): AD-A372595; NTSB-A-99-46; No Copyright; Avail: CASI; A01, Microfiche; A01, Hardcopy
The Safety Board is concerned about the lack of conspicuity of primary targets in ARTS systems. The Board concludes that increasing primary targets' visibility to controllers is essential to enhancing flight safety. Modify all variants of Automatic Radar Tracking System software to automatically track primary radar targets that have characteristics consistent with aircraft in flight and tag them with a persistent track symbol that will be continuously displayed to controllers. Further, this feature should be incorporated into all future Federal Aviation Administration terminal radar data processing systems. (A-9946)
DTIC
Flight Safety; Aircraft Accidents; Aircraft Accident Investigation; Collision Avoidance; Safety Management

20000026850 National Transportation Safety Board, Washington, DC USA
Safety Recommendation
Hall, Jim, National Transportation Safety Board, USA; May 28, 1999; 5p; In English
Report No.(s): AD-A372611; NTSB-A-99-47,THROUGH,50; No Copyright; Avail: CASI; A01, Microfiche; A01, Hardcopy
This report explains the accident involving a Beech T-35A, N140SW colliding with the ground near Rydall, Georgia, following an inflight separation of the right wing.
DTIC
Aircraft Accidents; Aircraft Accident Investigation; Collision Avoidance

20000027417 Lockheed Martin Aeronautical Systems, Marietta, GA USA
Lockheed Martin C-130J Natural Icing FAA Certification Program
Johnston, R. L., Lockheed Martin Aeronautical Systems, USA; Ryan, R. J., Lockheed Martin Aeronautical Systems, USA; 1999 Report to the Aerospace Profession: Forty Third Symposium Proceedings; September 1999, pp. 33-57; In English; See also 20000027414; Copyright; Avail: Issuing Activity
The C-130J is the modern variant of the legendary C-130 military transport. The changes incorporated in the "J" are the most dramatic of any version since the original was introduced in 1954. Through the application of mature technologies, new high performance engines, composite propellers, and a glass cockpit with computer controlled automation, virtually every system and aspect of the basic C-130 aircraft has undergone change. The ice protection system was no exception. It was redesigned to provide increased capability, and many lessons were learned during the comprehensive two-year icing certification program that culminated in Federal Aircraft Administration (FAA) Type Certification on 9 September 1998. The program included dry air testing for thermodynamic modeling icing tanker spray testing for validating subsystem performance, extensive simulated ice shape testing to verify adequate flying qualities, and natural ice testing to validate the design. Increased FAA attention to icing certification required more extensive testing and scrutiny than previous C-130 certification efforts. An atmosphere of compressed certification schedules and unexpected early test results created both design and testing challenges. These included design and fabrication of an icing tanker to replace the retired USAF KC-135A aircraft and a substantial redesign of the vertical tail ice protection system. When system redesign forced test performance into the summer months, the test team was compelled to relocate to Argentina in the Southern Hemisphere to find natural icing conditions and successfully complete critical program milestones. The 'pristine' southern Argentina atmosphere provided numerous icing events, including several encounters with large areas of supercooled large droplets (SLD). Since FAA certification does not currently require aircraft protection from SLD conditions, the test results are being considered by the FAA as input for changing the icing certification requirements for transport aircraft.
Author
C-130 Aircraft; Ice; Aircraft Icing; Ice Prevention; Flight Conditions; Deicing; Certification

20000027422 National Test Pilot School, Mojave, CA USA

Flight Test Safety in Civil Certification

Lewis, Gregory V., National Test Pilot School, USA; 1999 Report to the Aerospace Profession: Forty Third Symposium Proceedings; September 1999, pp. 112-118; In English; See also 20000027414; Copyright; Avail: Issuing Activity

The objective of this paper is to identify flight test hazards that are unique to the certification of new or modified aircraft. The paper then explains how the FAA and the National Test Pilot School (NTPS) are working together to reduce the impact of those hazards as well as the traditional hazards of flight testing. It should be noted at the outset that flight safety cannot be the primary goal in any program. All flying, including routine flying of fully certified aircraft, involves danger. If the most important goal is safety, then that can best be achieved by not flying at all. So the key is to achieve our technical goals while reducing the risks to an acceptable level.

Derived from text

Flight Tests; Flight Safety; Certification; Civil Aviation

20000027423 Air Line Pilots Association, Elmhurst, NY USA

Flight Test Results of the Controlled Flight Into Terrain Avoidance Maneuver in Fly-By-Wire Transports

Rogers, Ron, Air Line Pilots Association, USA; Stowe, Steve, Air Line Pilots Association, USA; Lutz, Terry, Air Line Pilots Association, USA; Kohler, Joe, Air Line Pilots Association, USA; 1999 Report to the Aerospace Profession: Forty Third Symposium Proceedings; September 1999, pp. 119-130; In English; See also 20000027414; Copyright; Avail: Issuing Activity

Controlled Flight into Terrain (CFIT) is the leading causes of aviation accidents. A test program was developed to compare the CFIT maneuver performance capabilities of Fly-By-Wire (FBW) aircraft with hard versus soft flight control limits, to obtain this data, simulated CFIT avoidance maneuvers utilizing a Boeing 777-300 and an Airbus A330-200 were performed. These tests were performed at the Boeing Flight Test Facility in Seattle, Washington and the Airbus Flight Test Facility at Toulouse, France. This flight test had a two-fold purpose. The first was to evaluate the effectiveness and appropriateness of a recovery technique that was developed for convention aircraft without regard for the flight envelope protections incorporated in modern FBW aircraft. The second purpose was to develop and/or evaluate CFIT escape maneuvers that utilize the maximum capability of the aircraft afforded by the protections incorporated in their respective FBW flight control systems. As a direct result of this flight test activity, United Airlines and Northwest Airlines have changed their CFIT escape maneuver for Airbus aircraft. US Airways, a new Airbus operator, adopted our recommendations front the onset.

Author

Fly by Wire Control; Aircraft Control; Terrain; Flight Tests; Flight Envelopes; Aircraft Maneuvers; Aircraft Performance

20000027424 Department of the Air Force, 412th Operations Group, Edwards AFB, CA USA

The A.R.T. of Ground Collision Avoidance System Testing

Wilson, Robert A., Department of the Air Force, USA; Seelos, Michael, Department of the Air Force, USA; 1999 Report to the Aerospace Profession: Forty Third Symposium Proceedings; September 1999, pp. 131-144; In English; See also 20000027414; Copyright; Avail: Issuing Activity

This paper discusses considerations developed by the Air Force Flight Test Center test system safety process for assessing the risk associated with testing ground collision avoidance systems (GCAS). It specifically discusses available reaction time (A.R.T.) as a tool used to assess the risk of test points flown by the F-16 Combined Test Force at Edwards Air Force Base, California, during Digital Terrain System (DTS) developmental test and evaluation. The A.R.T. system uses time to ground impact as a normalizing factor to define the risk associated with flying any given GCAS test point. The numerous risk factors associated with GCAS testing and the necessary assumptions required to conduct such testing safely are also discussed. The initial results of the DTS testing that affected the A.R.T. based risk assessment are presented along with how the risk assessment was changed based on the lessons learned about pilot reaction times and pilot comfort level. Overall, the paper emphasizes basic principles that apply to conducting GCAS testing in any type of aircraft from fighters to transports.

Author

Reaction Time; Test Pilots; Ground Tests; Flight Tests; Collision Avoidance; Flight Safety; Safety Factors

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.

20000025493 Federal Aviation Administration, William J. Hughes Technical Center, Atlantic City, NJ USA
Terminal Air Traffic Control Radar and Display System Recommendations for Monitoring Simultaneous Instrument Approaches
Morrow–Magyrits, Sherri; Ozmore, Richard; Dec. 1999; 30p; In English
Report No.(s): AD-A372400; ACT-540; DOT/FAA/CT-TN99/24; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Multiple Parallel Approach Program (MPAP), under the auspices of the FAA Secondary Surveillance Integrated Product Team, AND-450, was developed to evaluate the feasibility of conducting simultaneous parallel approaches using both current and advanced radar and display system technology. The program focused primarily on the capacity-enhancing benefits of a Precision Runway Monitor system with various airport configurations. MPAP conducted over 20 real-time, human-in-the-loop and fast-time modeling simulations since 1988. The purpose of these simulations was to develop procedures for independent approaches to quadruple, triple, and closely spaced dual parallel runways in instrument meteorological conditions. This report provides a history of all MPAP simulations conducted to date, including a description of the test criteria used to evaluate each test, the findings, and subsequent procedural and equipment recommendations.
DTIC
Air Traffic Control; Computerized Simulation; Instrument Approach; Display Devices

20000025768 Civil Aeromedical Inst., Oklahoma City, OK USA
Comparing Text and Graphics in Navigation Display Design ***Final Report***
Williams, Kevin W., Civil Aeromedical Inst., USA; February 2000; 18p; In English
Contract(s)/Grant(s): AM-A-HRR-519-99
Report No.(s): DOT/FAA/AM-00/8; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Thirty-six pilots were tested in a flight simulator on their ability to decide which of two airports was farther from a storm front, based on the manner in which information was presented on a navigational display. The results support the superiority of graphical over textual information display of nearest airport information. Pilots were significantly faster using the map display than using either the text-only display or the enhanced-text display. In addition, in contrast to an earlier study (Williams, 1999), pilots performed better using a north-up map than when using a track-up map. Discussion of the results focuses on recommendations for moving-map displays and the display requirements for support of the nearest-airport function within a navigational display.
Author
Navigation Aids; Display Devices; Air Navigation; Human-Computer Interface; Pilot Performance

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.

20000025323 NASA Langley Research Center, Hampton, VA USA
The Influence of Modulated Signal Risetime in Flight Electronics Radiated Immunity Testing with a Mode-Stirred Chamber
Ely, Jay J., NASA Langley Research Center, USA; Nguyen, Truong X., NASA Langley Research Center, USA; Scearce, Stephen A., NASA Langley Research Center, USA; January 2000; 17p; In English; Original contains color illustrations
Contract(s)/Grant(s): RTOP 522-14-21-02
Report No.(s): NASA/TM-2000-209844; NAS 1.15:209844; L-17943; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

For electromagnetic immunity testing of an electronic system, it is desirable to demonstrate its functional integrity when exposed to the full range and intensity of environmental electromagnetic threats that may be encountered over its operational life.

As part of this, it is necessary to show proper system operation when exposed to representative threat signal modulations. Modulated signal transition time is easily overlooked, but can be highly significant to system susceptibility. Radiated electromagnetic field immunity testing is increasingly being performed in Mode Stirred Chambers. Because the peak field vs. time relationship is affected by the operation of a reverberating room, it is important to understand how the room may influence any input signal modulation characteristics. This paper will provide insight into the field intensity vs. time relationship within the test environment of a mode stirred chamber. An understanding of this relationship is important to EMC engineers in determining what input signal modulation characteristics will be transferred to the equipment under test. References will be given for the development of this topic, and experimental data will be presented
Author
Field Tests; Service Life; Field Strength; Electromagnetic Compatibility

20000025333 NASA, Washington, DC USA
Touchdown: The Development of Propulsion Controlled Aircraft at NASA Dryden
Tucker, Tom, NASA, USA; 1999; 62p; In English; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This monograph relates the important history of the Propulsion Controlled Aircraft project at NASA's Dryden Flight Research Center. Spurred by a number of airplane crashes caused by the loss of hydraulic flight controls, a NASA-industry team lead by Frank W. Burcham and C. Gordon Fullerton developed a way to land an aircraft safely using only engine thrust to control the airplane. In spite of initial skepticism, the team discovered that, by manually manipulating an airplane's thrust, there was adequate control for extended up-and-away flight. However, there was not adequate control precision for safe runway landings because of the small control forces, slow response, and difficulty in damping the airplane phugoid and Dutch roll oscillations. The team therefore conceived, developed, and tested the first computerized Propulsion Controlled Aircraft (PCA) system. The PCA system takes pilot commands, uses feedback from airplane measurements, and computes commands for the thrust of each engine, yielding much more precise control. Pitch rate and velocity feedback damp the phugoid oscillation, while yaw rate feedback damps the Dutch roll motion. The team tested the PCA system in simulators and conducted flight research in F-15 and MD-11 airplanes. Later, they developed less sophisticated variants of PCA called PCA Lite and PCA Ultralite to make the system cheaper and therefore more attractive to industry. This monograph tells the PCA story in a non- technical way with emphasis on the human aspects of the engineering and flic,ht-research effort. It thereby supplements the extensive technical literature on PCA and makes the development of this technology accessible to a wide audience.
Derived from text
Flight Control; Propulsion; Thrust Control; Aircraft Control; Control Stability; Flight Management Systems; Maneuverability; Aircraft Stability

20000025557 NASA Langley Research Center, Hampton, VA USA
Improved Quality in Aerospace Testing Through the Modern Design of Experiments
DeLoach, R., NASA Langley Research Center, USA; [2000]; 24p; In English; 38th; 38th Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2000, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-0825; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper illustrates how, in the presence of systematic error, the quality of an experimental result can be influenced by the order in which the independent variables are set. It is suggested that in typical experimental circumstances in which systematic errors are significant, the common practice of organizing the set point order of independent variables to maximize data acquisition rate results in a test matrix that fails to produce the highest quality research result. With some care to match the volume of data required to satisfy inference error risk tolerances, it is possible to accept a lower rate of data acquisition and still produce results of higher technical quality (lower experimental error) with less cost and in less time than conventional test procedures, simply by optimizing the sequence in which independent variable levels are set.
Author
Experiment Design; Q Factors; Systematic Errors; Data Acquisition

20000025766 NASA Glenn Research Center, Cleveland, OH USA
NASA/FAA Tailplane Icing Program: Flight Test Report
Ratvasky, Thomas P., NASA Glenn Research Center, USA; VanZante, Judith Foss, DYNACS Engineering Co., Inc., USA; Sim, Alex, NASA Dryden Flight Research Center, USA; March 2000; 166p; In English
Contract(s)/Grant(s): DTFA03-95-90001; RTOP 548-21-23
Report No.(s): NASA/TP-2000-209908; NAS 1.60:209908; DOT/FAA/AR-99/85; E-12126; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This report presents results from research flights that explored the characteristics of an ice-contaminated tailplane using various simulated ice shapes attached to the leading edge of the horizontal tailplane. A clean leading edge provided the baseline case, then three ice shapes were flown in order of increasing severity. Flight tests included both steady state and dynamic maneuvers. The steady state points were 1G wings level and steady heading sideslips. The primary dynamic maneuvers were pushovers to various G-levels; elevator doublets; and thrust transitions. These maneuvers were conducted for a full range of flap positions and aircraft angle of attack where possible. The analysis of this data set has clearly demonstrated the detrimental effects of ice contamination on aircraft stability and controllability. Paths to tailplane stall were revealed through parameter isolation and transition studies. These paths are (1) increasing ice shape severity, (2) increasing flap deflection, (3) high or low speeds, depending on whether the aircraft is in a steady state (high speed) or pushover maneuver (low speed), and (4) increasing thrust. The flight research effort was very comprehensive, but did not examine effects of tailplane design and location, or other aircraft geometry configuration effects. However, this effort provided the role of some of the parameters in promoting tailplane stall. The lessons learned will provide guidance to regulatory agencies, aircraft manufacturers, and operators on ice-contaminated tailplane stall in the effort to increase aviation safety and reduce the fatal accident rate.
Author
Aircraft Icing; Horizontal Tail Surfaces; Aircraft Stability; Leading Edges; Flight Tests

20000026835 Illinois Univ., Aviation Research Lab., Savoy, IL USA
An Informational Approach to Skill Transfer ***Final Report, 21 Aug. 1993 - 20 Aug. 1997***
Lintern, Gavan, Illinois Univ., USA; Jan. 2000; 39p; In English
Contract(s)/Grant(s): MDA903-93-K-0006; Proj-201611022901
Report No.(s): AD-A372486; ARI-RN-2000-06; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy
This research program studied the nature of fundamental skills underlying the expertise of aircraft pilots. The research program included a review of the issues facing flight instruction. The specific tasks of landing a light aircraft and of navigating an aircraft through an unfamiliar area were selected for intensive study. The experimental projects undertaken in this program used a flight simulation system developed around a real time computer generated visual display. Two experimental paradigms were exploited. One was used to explore the visual information and skills used to support the aircraft landing task. As a means of identifying critical sources of information, experiments with experienced pilots examined how distortions in the simulated visual scene affected landing performance. The second paradigm evaluated transfer in a mission rehearsal task. A navigational database was developed and displayed via the visual simulation system. Flight students were taught navigational skills under different experimental conditions and were then tested in a realistic navigation condition.
DTIC
Flight Simulation; Aircraft Landing; Aircraft Pilots; Light Aircraft; Information Systems; Pilot Performance; Real Time Operation

20000026840 Fairchild Aircraft, San Antonio, TX USA
Development of a Supplemental Inspection Document for the Fairchild SA226 and SA227 Aircraft, Part 2
Dwyer, W., Fairchild Aircraft, USA; Oct. 1999; 255p; In English
Report No.(s): AD-A372525; DOT/FAA/AR-99/20-VOL-2-PT-2; No Copyright; Avail: CASI; A03, Microfiche; A12, Hardcopy
This report (consisting of volume I and volume II) is the second phase of a three-phase program sponsored by the Federal Aviation Administration to develop a supplemental inspection document for the Fairchild SA226 and SA227 aircraft. In this report, the results of material characterization and testing are presented. Crack growth analysis of all the critical structural elements using NASGRO is performed and the results documented.
DTIC
Aircraft Structures; Crack Propagation; Inspection; Aircraft Maintenance

20000026841 Fairchild Aircraft, San Antonio, TX USA
Development of a Supplemental Inspection Document for the Fairchild SA226 and SA227 Aircraft, Part 2
Dwyer, W., Fairchild Aircraft, USA; Oct. 1999; 633p; In English
Report No.(s): AD-A372526; DOT/FAA/AR-99/20-VOL-1-PT-2; No Copyright; Avail: CASI; A06, Microfiche; A99, Hardcopy
This report (consisting of volume I and volume II) is the second phase of a three-phase program sponsored by the Federal Aviation Administration to develop a supplemental inspection document for the Fairchild SA226 and SA227 aircraft. In this

report, the results of material characterization and testing are presented. Crack growth analysis of all the critical structural elements using NASGRO is performed and the results documented.
DTIC
Crack Propagation; Inspection; Aircraft Structures

20000027415 Boeing Co., Seattle, WA USA
Enhanced High AOA Maneuverability and Spin Recovery for the Super Hornet
Traven, Ricardo, Boeing Co., USA; Madenwald, Fred, Boeing Co., USA; Heller, Mike, Boeing Co., USA; Hoffman, Scott, Naval Surface Weapons Center, USA; 1999 Report to the Aerospace Profession: Forty Third Symposium Proceedings; September 1999, pp. 3-13; In English; See also 20000027414; Copyright; Avail: Issuing Activity

The F/A-18E/F Super Hornet incorporated several enhancements to high angle of attack maneuverability and controllability during the execution of the Engineering and Manufacturing Development (EMD) program. These modifications were developed and implemented in response to feedback from early operational assessments that indicated the Super Hornet had compromised some of the tactical utility available in the heritage F/A-18 aircraft by focusing too strongly on departure resistance. The combined efforts of the Boeing and Navy engineering team and the Integrated Test Team (ITT) responded to these challenges by adding the desired capabilities within the cost and schedule constraints of the EMD phase of the test program - providing those pilots with a highly-capable aircraft for the formal Operational Evaluation phase. These two design challenges are presented in this paper. First, the aircraft was designed to provide increased high AOA roll performance capability in an effort to meet next generation threats head-on. However, due to the increased departure resistance added to the Super Homet, the operational pilots were not able to achieve desired performance during a critical close-in air combat maneuver. Second, spin recoveries were acceptable with symmetric loadings, but improvement was desired, if possible, with various levels of lateral weight asymmetries. While this was not a design requirement, the Super Hornet is expected to be employed routinely in asymmetric loadings to provide maximum mission flexibility. In addition to these issues, a brief background of the high angle of attack control law philosophy is presented, as well as lessons learned from these experiences.
Author
F-18 Aircraft; Aircraft Control; Maneuverability; Aircraft Maneuvers; Controllability; Control Theory; Flight Characteristics

20000027416 Saab-Space A.B., Linkoeping, Sweden
GRIPEN High AoA and Spin Auto-Recovery Testing
Sjoeblom, Hans, Saab-Space A.B., Sweden; Johansson, Bjoern, FMV, Sweden; 1999 Report to the Aerospace Profession: Forty Third Symposium Proceedings; September 1999, pp. 14-32; In English; See also 20000027414; Copyright; Avail: Issuing Activity

Departure resistance including recovery from out of control flight-testing is something that most combat aircraft are tested for. Traditionally this kind of testing was of ”trial and error” type since adequate simulation facilities were not available. Today, in a world of modern digital flight control systems and sophisticated simulators, most of this testing can be done in a safe and cost effective simulator environment. However, actual flight-testing is still required for aerodata identification and verification as well as spot checking of aircraft behavior. The Gripen high AoA flight test program has been conducted in Sweden. The program has covered aerodata identification at high AoA, departure resistance, spin investigation and spin auto-recovery testing. This paper describes our test objectives, test approach, test preparations, test results and lessons learned.
Author
Flight Tests; Spin Tests; Flight Control; Fighter Aircraft

20000027419 British Aerospace Public Ltd. Co., Warton, UK
Eurofighter Typhoon Carefree Handling Phase One Trial Problems
Hartley, Keith, British Aerospace Public Ltd. Co., UK; 1999 Report to the Aerospace Profession: Forty Third Symposium Proceedings; September 1999, pp. 81-85; In English; See also 20000027414; Copyright; Avail: Issuing Activity

As part of Typhoon’s development program, Eurofighter have to demonstrate the aircraft’s carefree handling qualities: by ”carefree” I mean automatic departure and structural load protection, with no pilot-monitored handling or operating limitations. The programme requires a series of demonstrations as the aircraft capability and configurations expand; this paper is concerned with aspects of the first trials phase, completed last year. As well as being a crucial demonstration of our ability to provide carefree handling, these first trials were commercially very important - a successful first demonstration over an envelope agreed with the customer was an essential pre-requisite to him signing the first stages of the production contract. We therefore approached the trials in the usual flight test environment - tight timescales, lots of interest from the high-priced help, and a need to complete the programme within the commercial and contractural needs. The high AOA carefree handling testing is the responsibility of British

Aerospace's flight test centre in Warton, England. The following paper discusses some of the problems that arose during the trial: although I'm obliged to get into some technical detail, the lessons learned apply to most areas of flight test.
Derived from text
Controllability; Aircraft Control; Maneuverability; Automatic Control

20000027420 Boeing Co., Seattle, WA USA
Developing the Crosswind Takeoff and Landing Envelope for the F/A-18E/F "Super Hornet"
Desmond, Dave, Boeing Co., USA; Melton, Henry, III, Naval Air Warfare Center, USA; Tribino, Michael A., Naval Air Warfare Center, USA; 1999 Report to the Aerospace Profession: Forty Third Symposium Proceedings; September 1999, pp. 86-97; In English; See also 20000027414; Copyright; Avail: Issuing Activity

Demonstration of the F/A-18 EfF "Super Hornet" crosswind takeoff and landing capability were required as part of the Engineering, Manufacturing and Development (EMD) program. A maximum crosswind takeoff and landing capability, to 30 kt, was desired to allow maximum flexibility for the fleet users for both symmetric and asymmetric store loadings. One of the many technical challenges of this flight test program included the development of a landing technique which would be recommended for the fleet pilots. This technique had to provide satisfactory approach handling qualities with acceptable pilot workload. Additionally, once on-deck, the landing loads a(touchdown and the landing rollout characteristics were all critical to determining the optimum landing technique. Several crosswind landing techniques were evaluated. These included the wing-down-top-rudder (WDTR), crabbed, and crabbed approach and landing; with half and full-crab kickout just prior to touchdown. These tests were conducted at the Rogers Dry Lakebed, Edwards AFB, CA in the spring of 1998. Testing was scheduled at this facility because of the high natural winds and the availability of several lakebed runways, which would allow the test to be completed safely and efficiently. Due to the excellent aircraft flying qualities, performance, and favorable wind conditions, 38 demonstration crosswind takeoff and landings were completed in 9 days. The takeoff and landings were completed in three aircraft loadings with crosswind up to 30 knots. The most critical loading tested was the crosswind into the light wing of the airplane with 26,000 ft-lb lateral weight asymmetry. This paper will discuss the rest setup, test technique, safety issues, results, and conclusions for the development of the crosswind takeoff and landing envelope of the F/A-18 E/F "Super Hornet".
Author
Wind Direction; Wind Velocity; Takeoff; F-18 Aircraft; Flight Tests; Aircraft Configurations; Aircraft Design

20000027421 Lockheed Martin Corp., Skunk Works, Palmdale, CA USA
"Give Me a Brake" F-117 Digital Brake Control Testing
Brown, James E., III, Lockheed Martin Corp., USA; 1999 Report to the Aerospace Profession: Forty Third Symposium Proceedings; September 1999, pp. 98-109; In English; See also 20000027414; Copyright; Avail: Issuing Activity

The F-117A Combined Test Force (CTF), Plant 42, Palmdale, CA conducted a developmental test of a new Digital Brake Control Box (DBCB) from October 1998 to March 1999. Developmental testing of the DBCB involved system functional checkout, taxi testing and increasing brake energy stops. The end point was a 100% brake energy Rejected Takeoff (RTO). What the contractor perceived as a quick form fit and function digital replacement for an existing analog system resulted in an extended and often problematic developmental test program. The DBCB test program resulted in a much enhanced brake and anti-skid control system for the F-117A aircraft. Additional functionality was provided to the pilot, failure modes were reduced and numerous troubleshooting benefits for the maintainer were realized. Lessons learned include thorough test planning, disciplined test conduct and the poor assumptions involved with the conversion of systems from analog to digital control.
Author
Digital Systems; Aircraft Brakes; Antiskid Devices; F-117A Aircraft; Braking; Systems Engineering

20000027426 National Test Pilot School, Mojave, CA USA
The USA Army XV-11A STOL Program
Roberts, Sean C., National Test Pilot School, USA; 1999 Report to the Aerospace Profession: Forty Third Symposium Proceedings; September 1999, pp. 156-174; In English; See also 20000027414; Copyright; Avail: Issuing Activity

This paper highlights the research efforts that culminated in the design and flight testing of the U.S. Army S.T.O.L. research vehicle.
Derived from text
Flight Tests; XV-11A Aircraft; X-1 Aircraft; Research and Development; Takeoff; Aircraft Performance

20000027427 NASA, Washington, DC USA

G-300 Unlimited Aerobatic Aircraft Development and Flight Test

Meyer, Robert, NASA, USA; Meyer, Marta, NASA, USA; 1999 Report to the Aerospace Profession: Forty Third Symposium Proceedings; September 1999, pp. 175-193; In English; See also 20000027414; Copyright; Avail: Issuing Activity

This paper will contain a brief description of competition aerobatics, the background for the development of the G-300, a description of the G-300 aircraft, a description of a high quality low cost data acquisition system, results of the flight test, and other interesting observations associated with the extreme agility of this aircraft. The interesting observations include, handling quality characteristics in all three axis, the authors qualitative assessment of the desirability of the reclined and elevated feet cockpit configuration, and the authors assessment of the practicality of very high roll rates for precision rolls required during competition aerobatics.

Derived from text

Aerobatics; Aircraft Design; Graphite; Composite Structures; Composite Materials; Airframe Materials; Airframes; Aircraft Performance; Flight Tests; Ground Tests

20000027429 Vision Air, Australia

Flight Without Legs: The Conception, Development and Certification of the ”Vision Air” Hand Control

Duncan, Suzi, Vision Air, Australia; 1999 Report to the Aerospace Profession: Forty Third Symposium Proceedings; September 1999, pp. 205-209; In English; See also 20000027414; Copyright; Avail: Issuing Activity

”Vision Air” originally was to serve two purposes. One to make flying for the physically disabled as accessible as it is for the able bodied individual and secondly to raise money and therefore provide scholarships for those who are financially disadvantaged as well as physically disabled.

Derived from text

Certification; Pert; Management Methods; Project Management; Disabilities

20000027441 NASA Langley Research Center, Hampton, VA USA

Additional F-Functions Useful for Preliminary Design of Shaped-Signature, Low-Boom, Supersonic-Cruise Aircraft

Mack, Robert J., NASA Langley Research Center, USA; High-Speed Research: 1994 Sonic Boom Workshop. Configuration, Design, Analysis and Testing; December 1999, pp. 1-12; In English; See also 20000027440; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Two additional low-boom F-functions have been described for use in designing low-boom, shaped-pressure-signature, supersonic-cruise aircraft. Based on the minimization studies of Seebass and George, the drag-nose shock strength trade-off modification of Darden, and the practical modification of Haglund, their use can aid in the design of conceptual low-boom aircraft, provide additional flexibility in the shaping of the low-boom aircraft nose section, and extend the applicability of shaped-pressure-signature methodology.

Author

Sonic Booms; Aircraft Design; Supersonic Aircraft; Aerodynamic Configurations; Bodies of Revolution; Noses (Forebodies)

20000027449 NASA Langley Research Center, Hampton, VA USA

A Performance Assessment of Eight Low-Boom High-Speed Civil Transport Concepts

Baize, Daniel G., NASA Langley Research Center, USA; McElroy, Marcus O., NASA Langley Research Center, USA; Fenbert, James A., NASA Langley Research Center, USA; Coen, Peter G., NASA Langley Research Center, USA; Ozoroski, Lori P., Lockheed Engineering and Sciences Co., USA; Domack, Chris S., Lockheed Engineering and Sciences Co., USA; Needleman, Kathy E., Lockheed Engineering and Sciences Co., USA; Geiselhart, Karl A., Lockheed Engineering and Sciences Co., USA; High-Speed Research: 1994 Sonic Boom Workshop. Configuration, Design, Analysis and Testing; December 1999, pp. 149-170; In English; See also 20000027440; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

A performance assessment of eight low-boom high speed civil transport (HSCT) configurations and a reference HSCT configuration has been performed. Although each of the configurations was designed with different engine concepts, for consistency, a year 2005 technology, 0.4 bypass ratio mixed-flow turbofan (MFTF) engine was used for all of the performance assessments. Therefore, all original configuration nacelles were replaced by a year 2005 MFRF nacelle design which corresponds to the engine deck utilized. The engine thrust level was optimized to minimize vehicle takeoff gross weight. to preserve the configuration’s sonic-boom shaping, wing area was not optimized or altered from its original design value. Performance sizings were completed when possible for takeoff balanced field lengths of 11,000 ft and 12,000 ft, not considering FAR Part 36 Stage III noise compliance. Additionally, an arbitrary sizing with thrust-to-weight ratio equal to 0.25 was performed, enabling performance levels to be compared independent of takeoff characteristics. The low-boom configurations analyzed included

designs from the Boeing Commercial Airplane Group, Douglas Aircraft Company, Ames Research Center, and Langley Research Center. This paper discusses the technology level assumptions, mission profile, analysis methodologies, and the results of the assessment. The results include maximum lift-to-drag ratios, total fuel consumption, number of passengers, optimum engine sizing plots, takeoff performance, mission block time, and takeoff gross weight for all configurations. Results from the low-boom configurations are also compared with a non-low-boom reference configuration. Configuration dependent advantages or deficiencies are discussed as warranted.
Author
Sonic Booms; Supersonic Transports; Aircraft Design; Aircraft Configurations; Aircraft Structures; Aerodynamic Configurations; Propulsion System Configurations

20000027450 NASA Dryden Flight Research Center, Edwards, CA USA
Measurements of the Basic SR-71 Airplane Near-Field Signature
Haering, Edward A., Jr., NASA Dryden Flight Research Center, USA; Whitmore, Stephen A., NASA Dryden Flight Research Center, USA; Ehernberger, L. J., NASA Dryden Flight Research Center, USA; High-Speed Research: 1994 Sonic Boom Workshop. Configuration, Design, Analysis and Testing; December 1999, pp. 171-197; In English; See also 20000027440; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Airplane design studies have developed configuration concepts that may produce lower sonic boom annoyance levels. Since lower noise designs differ significantly from other HSCT designs, it is necessary to accurately assess their potential before HSCT final configuration decisions are made. Flight tests to demonstrate lower noise design capability by modifying an existing airframe have been proposed for the Mach 3 SR-71 reconnaissance airplane. to support the modified SR-71 proposal, baseline in-flight measurements were made of the unmodified aircraft. These measurements of SR-71 near-field sonic boom signatures were obtained by an F-16XL probe airplane at flightpath separation distances ranging from approximately 740 to 40 ft. This paper discusses the methods used to gather and analyze the flight data, and makes comparisons of these flight data with CFD results from Douglas Aircraft Corporation and NASA Langley Research Center. The CFD solutions were obtained for the near-field flow about the SR-71, and then propagated to the flight test measurement location using the program MDBOOM.
Derived from text
Flight Tests; Near Fields; Sonic Booms; Supersonic Transports; SR-71 Aircraft; Aircraft Design; In-Flight Monitoring; Aerodynamic Configurations

20000027453 NASA Dryden Flight Research Center, Edwards, CA USA
Low-Boom SR-71 Modified Signature Demonstration Program
Lux, David, NASA Dryden Flight Research Center, USA; Ehernberger, L. J., NASA Dryden Flight Research Center, USA; Moes, Timothy R., NASA Dryden Flight Research Center, USA; Haering, Edward A., NASA Dryden Flight Research Center, USA; High-Speed Research: 1994 Sonic Boom Workshop. Configuration, Design, Analysis and Testing; December 1999, pp. 237-248; In English; See also 20000027440; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

A flight program using the SR-71 airplane to validate sonic boom technologies for High-Speed Commercial Transport (HSCT) operation and potentially for low- or softened-boom design configurations is described. This program employs a shaped signature modification to the SR-71 airplane which is designed to demonstrate computational fluid dynamics (CFD) design technology at a full-scale HSCT operating condition of Mach 1.8 at 48,000 feet altitude. Test plans call for measurements in the near-field, at intermediate propagation altitudes, and through the more turbulent boundary layer near the Earth surface. The shaped signature modification to the airplane is comprised of added cross-section areas on the underside of the airplane forward of the wing and engine nacelles. Because the flight demonstration does not approach maximum SR-71 altitude or Mach number, the airplane provides more than adequate performance and maneuver margins for safe operation of the modified airplane. Probe airplane measurements in the near-field will use fast response pressure sensors. Far-field and ground-based boom measurements will use high response microphones or conventional sonic boom field recorders. Scope of the planned demonstration flights also includes ground level measurements during conditions which cause minimal signature distortion and conditions which cause high distortion of the signature.
Author
Sonic Booms; SR-71 Aircraft; Flight Tests; Supersonic Transports; Turbulent Boundary Layer; Aircraft Design; Design Analysis

20000027614 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne Australia
Estimation of Structural Component Loads in Helicopters: A Review of Current Methodologies
Polanco, Frank G.; Dec. 1999; 40p; In English
Report No.(s): AD-A372893; DSTO-TN-0239; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A review of the literature for models that use fixed component loads and flight parameters to determine loads in a dynamic component is presented. The reviewed papers naturally divide into one of three categories depending on the information they use to determine the load in the dynamic component. An initial section on load variability demonstrates that even for the same aircraft under the same flight condition, the loading can vary dramatically due to pilot technique, altitude, and weight to name a few variables. Neural networks, regression, and statistical indicators prove invaluable in developing load models. The review also demonstrated a lack of solutions to fundamental questions concerning loads modelling.
DTIC
Loads (Forces); Structural Analysis

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.

20000025301 NASA Glenn Research Center, Cleveland, OH USA
Performance and Durability of High Temperature Foil Air Bearings for Oil-Free Turbomachinery
DellaCorte, C., NASA Glenn Research Center, USA; Valco, M. J., Army Research Lab., USA; Radil, K. C., Army Research Lab., USA; Heshmat, H., Mohawk Innovative Technology, Inc., USA; November 1999; 20p; In English, 7-11 May 2000, Nashville, TN, USA; Sponsored by Society of Tribologists and Lubrication Engineers, USA
Contract(s)/Grant(s): RTOP 523-22-13
Report No.(s): NASA/TM-1999-209187; E-11697; NAS 1.15:209187; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The performance and durability of advanced, high temperature foil air bearings are evaluated under a wide range (10 to 50 kPa) of loads at temperatures from 25 to 650 C. The bearings are made from uncoated nickel based superalloy foils. The foil surface experiences sliding contact with the shaft during initial start/stop operation. to reduce friction and wear, the solid lubricant coating, PS304, is applied to the shaft by plasma spraying. PS304 is a NiCr based Cr2O3 coating with silver and barium fluoride/calcium fluoride solid lubricant additions. The results show that the bearings provide lives well in excess of 30,000 cycles under all of the conditions tested. Several bearings exhibited lives in excess of 100,000 cycles. Wear is a linear function of the bearing load. The excellent performance measured in this study suggests that these bearings and the PS304 coating are well suited for advanced high temperature, oil-free turbomachinery applications.
Author
Foil Bearings; Turbomachinery; Metal Foils

20000025390 NASA Lewis Research Center, Cleveland, OH USA
Comparison Analysis Between Nevada and TSS Using a Jet Engine Exhaust Nozzle Test Rig
Baumeister, Joseph F., NASA Lewis Research Center, USA; Yuko, James R., NASA Lewis Research Center, USA; Ninth Thermal and Fluids Analysis Workshop Proceedings; November 1999, pp. 49-67; In English; See also 20000025387; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Thermal analysis in both simple and complex models can require calculating the propagation of radiant energy to and from multiple surfaces. This can be accomplished through simple estimation techniques or complex computationally intense computer modeling simulations. Currently there are a variety of computer analysis techniques used to simulate the propagation of radiant energy, each having advantages and disadvantages. The major objective of this effort was to compare two ray tracing radiation propagation analysis programs (NEVADA and TSS) Net Energy Verification and Determination Analyzer and Thermal Synthesizer System with experimental data. Results from a non-flowing, electrically heated test rig was used to verify the calculated radiant energy propagation from a nozzle geometry that represents an aircraft propulsion nozzle system. In general the programs produced comparable overall results, and results slightly higher then the experimental data. Upon inspection of individual radiation interchange factors, differences were evident and would have been magnified if a more radical model temperature profile was analyzed. Bidirectional reflectivity data (BRDF) was not used do to modeling limitations in TSS. For code comparison purposes, this nozzle geometry represents only one case for one set of analysis conditions. Since each computer code

has advantages and disadvantages bases on scope, requirements, and desired accuracy, the usefulness of this single case study may be limiting.
Author
Jet Engines; Exhaust Nozzles; Engine Tests; Thermal Analysis; Synthesizers; Applications Programs (Computers); Ray Tracing

20000027604 American Inst. of Aeronautics and Astronautics, New York, NY USA
Rolls-Royce Industrial Trent: Combustion and Other Technologies
Barkey, C.; Richards, S.; Harrop, N.; Kotsiopriftis, P.; Mastroberardino, R.; Jan. 1999; 8p; In English
Report No.(s): AD-A373340; ISABE-99-7285; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

In 1993, Rolls-Royce Gas Turbine Engines Canada Inc. (today an integral part of Rolls-Royce Canada) was launched to develop a dry low emissions (DLE) industrial derivative of the aero Trent engine. The aero Trent is now in service powering the Boeing 777 aircraft and the Airbus A330. The Trent 800 is certified at 90,000 lb. thrust and was the first engine in the world to be certified at that level. The industrial version builds on this pedigree and follows a long lineage of aero derivative industrial engines. It has the declared objectives to provide customers with 50MW of power, a life of 25,000 hours for all hot end parts and 50,000 hours on other components, and a thermal efficiency of 42 percent. to build on the experience of the Rolls-Royce RB211-DLE industrial engine, the selected combustor configuration for the 35:1 compression ratio engine was of a cannular design with 3 lean-premix stages in series (primary, secondary, and tertiary stages). The development program for natural gas operation is now at a stage where the main advantages of the 3 stage combustor and other technology features on the Trent can be documented.
DTIC
Aircraft Engines; Gas Turbines; Combustion Chambers

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.

20000025434 NASA Langley Research Center, Hampton, VA USA
Reference H Piloted Assessment (LaRC.1) Pilot Briefing Guide
Jackson, E. Bruce, NASA Langley Research Center, USA; Raney, David L., NASA Langley Research Center, USA; Hahne, David E., NASA Langley Research Center, USA; Derry, Stephen D., NASA Langley Research Center, USA; Glaab, Louis J., Lockheed Martin Engineering and Sciences Co., USA; December 1999; 102p; In English
Contract(s)/Grant(s): RTOP 537-08-23-21
Report No.(s): NASA/TM-1999-209533; L-17903; NAS 1.15:209533; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This document describes the purpose of and method by which an assessment of the Boeing Reference H High-Speed Civil Transport design was evaluated in the NASA Langley Research Center's Visual/Motion Simulator in January 1997. Six pilots were invited to perform approximately 60 different Mission Task Elements that represent most normal and emergency flight operations of concern to the High Speed Research program. The Reference H design represents a candidate configuration for a High-Speed Civil Transport, a second generation supersonic civilian transport aircraft. The High-Speed Civil Transport is intended to be economically sound and environmentally safe while carrying passengers and cargo at supersonic speeds with a trans-Pacific range. This simulation study was designated "LaRC. 1" for the purposes of planning, scheduling and reporting within the Guidance and Flight Controls super-element of the High-Speed Research program. The study was based upon Cycle 3 release of the Reference H simulation model.
Author
Civil Aviation; Flight Control; Flight Operations; Motion Simulators; Evaluation

20000027418 Federal Aviation Administration, ACO Flight Test Branch, Seattle, WA USA
Certification of Spin Resistant Aircraft
Arnold, Eugene, Federal Aviation Administration, USA; 1999 Report to the Aerospace Profession: Forty Third Symposium Proceedings; September 1999, pp. 58-78; In English; See also 20000027414; Copyright; Avail: Issuing Activity

Research by NASA & FAA during the 1980's identified promising ways to improve spin resistance of light airplanes through enhanced wing leading edge design modifications. Certification Standards were subsequently developed and implemented for Spin

Resistant aircraft via FAA NPRM Notice 89-5 (Mar 6, 1989) and FAR Part 23 Amendment 23-42 (Jan 3, 1991). The purpose was to reduce the number of general aviation stall/spin accidents, particularly at low altitude. Development of Spin Resistance Certification Criteria was initiated after a GAMA General Aviation Stall/Spin Workshop in Oct 1981. The Development of Spin Resistant Criteria was promoted by results of NASA Flight Tests on three typical single engine aircraft (AA-1X, C-23A, & PA-28RX). Several SAE and AIAA papers during the 1980's addressed "Spin Resistance", the NASA Spin Resistance tests, and "Development of Spin Resistance Criteria for Light General Aviation Aircraft". Initial TC Applications for certification as "Spin Resistant" were submitted for the Devore Sunbird (Hi Wing Single Engine Pusher/No Canard) and the OMAC Laser 300 (Turboprop Pusher Canard). For unrelated reasons, neither aircraft received full certification. Until recently, the JETCRUZER (Single Engine Turboprop Pusher Canard) was the only SE Aircraft to receive "Spin Resistant" certification, although with numerous limitations. Within the past two years, both the Cirrus SR-20 and Lancair Columbia 300 sought some form of Spin Resistant certification. Both received full certification in the fall of 1998, however neither was certified as fully spin resistant. Spin resistance certification testing is presently not addressed in AC 23-8A (Part 23 Flight Test Guide) and only briefly discussed in AC 23-15 (Small Aircraft Certification Compliance Program). Draft "Spin Resistant Testing" advisory material has been written, but not formally adopted. Additionally, Spin Resistance is presently a disharmony between FAR/JAR Part 23. During Lancair LC-40 certification tests, issues were identified regarding spin resistance, present FAR 23 spin resistant criteria, and interpretation of the FAR Part 23 spin resistant criteria. This presentation will discuss the evolution of "spin resistance" certification criteria, issues regarding "spin resistance" certification criteria, and "spin resistance" certification issues that came up during the Lancair LC-40 certification program.
Author
Certification; Aircraft Spin; Aerodynamic Stalling; Spin Dynamics; Spin Tests; Aircraft Accidents; Flight Tests; Leading Edges; Wings

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).

20000026824 National Aerospace Lab., Tokyo Japan
Development of the Job Scheduler for the Numerical Wind Tunnel
Suematu, K.; May 1999; 18p; In Japanese; Portions of this document are not fully legible
Report No.(s): PB2000-102565; NAL-TR-1383; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Numerical Wind Tunnel, NWT is a CFD-oriented vector parallel computer system with distributed memory. We developed a job scheduler to utilize the NWT effectively and put it into operation in October 1994. Since then, we have added various functions to the job scheduler to enhance the manageability of the NWT. It now achieves effective use of the processing elements (PE's) and execute tasks with a suitable turn-around time. This paper reports the functions and availability of the job scheduler for NWT use.
NTIS
Wind Tunnels; Computational Fluid Dynamics; Scheduling; Sequencing; Tasks

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.

20000025321 Alpha Technology, Huntsville, AL USA
Human Mars Mission: Weights and Mass Properties, Pt. 1 ***Final Report, 7 May - 30 Sep. 1999***
Brothers, Bobby, Alpha Technology, USA; Oct. 07, 1999; 40p; In English
Contract(s)/Grant(s): NASA Order H-28653-D
Report No.(s): NASA/CR-2000-209874/PT1; NAS 1.26:209874/PT1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents a final report from May 7, 1999 to September 30, 1999 on the Human Mars Mission Weights and Mass Properties. The topics include: 1) Chemical DRM (Design Reference Mission) v4.0a Architecture; 2) Nuclear DRM v4.0a Architecture; 3) SEP DRM v4.0a Architecture; 4) Cargo Flights 1 and 2; 5) Crew Taxi Stage; and 6) X-38 Manned Vehicle. This paper is presented in viewgraph form.
CASI
Mars Missions; Weight Measurement; Mission Planning

20000025322 Alpha Technology, Huntsville, AL USA
Human Mars Mission: SEP Architecture, Crew Taxi Propulsion Stage Study and Design and Technology for Reaction and Control System, Pt. 1 ***Final Report, 7 May - 30 Sep. 1999***
Young, Archie, Alpha Technology, USA; Oct. 07, 1999; 47p; In English
Contract(s)/Grant(s): NASA Order H-28653-D; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Mars exploration is a candidate pathway to expand human presence and useful activities in the solar system. There are several propulsion system options being considered to place the Mars payload on its interplanetary transfer trajectory. One propulsion option is the use of Solar Electric Propulsion (SEP) to spiral out with the Mars payload from an initial Low Earth Orbit (LEO) to an elliptical High Earth Orbit (HEO). This report, presented in annotated facing page format, describes the work completed on the design of a crew taxi propulsion stage used in conjunction with the SEP. Transportation system/mission analysis topics covered in this report include sub-system analysis, trajectory profile description, mass performance and crew taxi stage sizing, stage configuration, stage cost, and Trans-Mars Injection (TMI) launch window. The high efficiency of SEP is used to provide the major part of the TMI propulsion maneuver. Orbital energy is continuously added over a period of approximately twelve months. The SEP and Mars payload follow a spiral trajectory from an initial LEO to a final elliptical HEO. A small chemical stage is then used to provide the final part of the TMI. The now unloaded SEP returns to LEO to repeat another spiral trajectory with payload to HEO. The spiral phase of the SEP's trajectory takes several months to reach HEO, thus significantly increasing the exposure time of the crew to zero-gravity. In order to minimize the long zero-gravity effects, a high thrust chemical stage delivers the crew to the SEP's HEO. The crew rendezvous with the Mars payload in HEO. After a checkout period the Mars payload with the crew is injected onto a Trans-Mars Trajectory by a small chemical stage.
Author
Mars Exploration; Solar Electric Propulsion; Systems Analysis; Low Earth Orbits

20000025485 Alpha Technology, Huntsville, AL USA
Human Mars Mission: Launch Window from Earth Orbit, Pt. 1 ***Final Report, 7 May - 30 Sep. 1999***
Young, Archie, Alpha Technology, USA; Oct. 07, 1999; 50p; In English
Contract(s)/Grant(s): NASA Order H-28653-D
Report No.(s): NASA/CR-2000-209875/PT1; NAS 1.26:209875/PT1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The determination of orbital window characteristics is of major importance in the analysis of human interplanetary missions and systems. The orbital launch window characteristics are directly involved in the selection of mission trajectories, the development of orbit operational concepts, and the design of orbital launch systems. The orbital launch window problem arises because of the dynamic nature of the relative geometry between outgoing (departure) asymptote of the hyperbolic escape trajectory and the earth parking orbit. The orientation of the escape hyperbola asymptotic relative to earth is a function of time. The required hyperbola energy level also varies with time. In addition, the inertial orientation of the parking orbit is a function of time because of the perturbations caused by the Earth's oblateness. Thus, a coplanar injection onto the escape hyperbola can be made only at a point in time when the outgoing escape asymptote is contained by the plane of parking orbit. Even though this condition may be planned as a nominal situation, it will not generally represent the more probable injection geometry. The general case of an escape injection maneuver performed at a time other than the coplanar time will involve both a path angle and plane change and, therefore, a DELTA V penalty. Usually, because of the DELTA V penalty the actual departure injection window is smaller in duration than that determined by energy requirement alone. This report contains the formulation, characteristics, and test cases for five different launch window modes for Earth orbit. These modes are: (1) One impulsive maneuver from a Highly Elliptical Orbit (HEO) (2) Two impulsive maneuvers from a Highly Elliptical Orbit (HEO) (3) One impulsive maneuver from a Low Earth Orbit (LEO) (4) Two impulsive maneuvers from LEO (5) Three impulsive maneuvers from LEO.
Author
Launch Windows; Low Earth Orbits; Mars Missions; Elliptical Orbits; Spacecraft Launching

20000027387 Lunar and Planetary Inst., Houston, TX USA

Space Resource Roundtable Rationale

Duke, Michael B., Lunar and Planetary Inst., USA; Space Resources Utilization Roundtable; 1999, pp. 5; In English; See also 20000027384; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Recent progress in the U.S. Space Program has renewed interest in space resource issues. The Lunar Prospector mission conducted in NASA's Discovery Program has yielded interesting new insights into lunar resource issues, particularly the possibility that water is concentrated in cold traps at the lunar poles. This finding has not yet triggered a new program of lunar exploration or development, however it opens the possibility that new Discovery Missions might be viable. Several asteroid missions are underway or under development and a mission to return samples from the Mars satellite, Phobos, is being developed. These exploration missions are oriented toward scientific analysis, not resource development and utilization, but can provide additional insight into the possibilities for mining asteroids. The Mars Surveyor program now includes experiments on the 2001 lander that are directly applicable to developing propellants from the atmosphere of Mars, and the program has solicited proposals for the 2003/2005 missions in the area of resource utilization. These are aimed at the eventual human exploration of Mars. The beginning of construction of the International Space Station has awakened interest in follow-on programs of human exploration, and NASA is once more studying the human exploration of Moon, Mars and asteroids. Resource utilization will be included as objectives by some of these human exploration programs. At the same time, research and technology development programs in NASA such as the Microgravity Materials Science Program and the Cross-Enterprise Technology Development Program are including resource utilization as a valid area for study. Several major development areas that could utilize space resources, such as space tourism and solar power satellite programs, are actively under study.

Derived from text

Space Programs; Lunar Exploration; Lunar Prospector; Lunar Resources

20000027390 Georgia Inst. of Tech., Atlanta, GA USA

Acoustic Shaping: Enabling Technology for a Space-Based Economy

Komerath, N. M., Georgia Inst. of Tech., USA; Matos, C. A., Georgia Inst. of Tech., USA; Coker, A., Georgia Inst. of Tech., USA; Wanis, S., Georgia Inst. of Tech., USA; Hausaman, J., Georgia Inst. of Tech., USA; Ames, R. G., Georgia Inst. of Tech., USA; Tan, X. Y., Georgia Inst. of Tech., USA; Space Resources Utilization Roundtable; 1999, pp. 11-12; In English; See also 20000027384; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This abstract presents three points for discussion: (1) Key to the development of civilization in space, is a space-based marketplace, where the need to compete in earth-based markets is removed, along with the constraint of launch costs from Earth. (2) A body of technical results, obtained by the authors' team, indicates promise for non-contact manufacturing in space, of low-cost items required for human presence in space. This is presented along with various other techniques which hold promise. (3) The economics of starting a space-based production company are heavily dependent on the presence of a rudimentary infrastructure. A national-level investment in space-based infrastructure, would be an essential catalyst for the development of a space-based economy. Some suggestions for the beginnings of this infrastructure are repeated from the literature.

Author

Space Manufacturing; Economics; Surface Geometry; Acoustics; Technology Utilization

20000027391 NASA Goddard Space Flight Center, Greenbelt, MD USA

Return to the Moon: A New Strategic Evaluation

Lowman, Paul D., Jr., NASA Goddard Space Flight Center, USA; Space Resources Utilization Roundtable; 1999, pp. 13; In English; See also 20000027384; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

This paper reviews the value of a new lunar program, initially robotic and eventually manned, in the light of developments since the 1991 Synthes Group study of the Space Exploration Initiative. The objective is to evaluate a return to the Moon in comparison to proposed Mars programs as a focus for American space exploration with humans in the next century. The Moon is demonstrably accessible, hospitable, useful, and interesting. Lunar programs are inherently faster and less risky from a programmatic viewpoint than comparable Mars programs such as Mars Direct. The dominant reason for a resumption of manned lunar missions, focused on a single site such as Grimaldi, is to rebuild the infrastructure for missions beyond Earth orbit, the last of which was in 1972. A transitional prograrr@ corresponding to the 10 Gemini missions that bridged the gap between Mercury and Apollo, was considered absolutely essential by the Synthesis Group. Further justification for a return to the Moon is the demonstrated feasibility of a robotic lunar observatory, concentrating on optical and infrared interferometry. Many unsolved scientific questions about the Moon itself remain, and could be investigated using telerobotic lunar rovers even before the return of humans. Mars is unquestionably more interesting scientifically and far more hospitable for long-term colonization. A new lunar program would be the most effective possible preparation for the human exploration, settlement and eventually the terraforming

of Mars. Lunar and Mars programs are complementary, not competitive. Both can be justified in the most fundamental terms as beginning the dispersal of the human species against uncontrollable natural disasters, cometary or asteroidal impacts in particular, to which mankind is vulnerable while confined to a single planet. Three specific programs are recommended for the 2001-2010 period: Ice Prospectors, to evaluate polar ice or hydrogen deposits; a robotic lunar observatory; and a manned lunar base and observatory.
Author
Moon; Lunar Roving Vehicles; Space Exploration; Lunar Programs

14
GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

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

20000025611 Royal Aeronautical Society, London, UK
On Trial in the Millennium: UK Guided Weapon Testing Facilities Now and in the Future: Proceedings
2000; 58p; In English; On Trial in the Millennium: UK Guided Weapon Testing Facilities Now and in the Future, 17 Feb. 2000, UK; See also 20000025612 through 20000025617; ISBN 1-85768-176-2; Copyright; Avail: Issuing Activity

This publication contains several papers. Included are: Applying Synthetic Environments to Support System Test and Trials; The Case for 'Joined Up' Testing; A European Approach to Test and Evaluation; Towers of Excellence; Torpedo Testing Facilities; and Range Selection Issues for the Storm Shadow Program.
CASI
Conferences; Weapon Systems

20000025612 Matra BAe Dynamics, Stevenage, UK
Applying Synthetic Environments to Support System Test and Trials
Smith, Rob, Matra BAe Dynamics, UK; On Trial in the Millennium: UK Guided Weapon Testing Facilities Now and in the Future: Proceedings; 2000, pp. 2.1 - 2.6; In English; See also 20000025611; Copyright; Avail: Issuing Activity

Synthetic Environments (SE) is becoming an important aspect of modern weapon system development. The key technologies of SE are now becoming mature and can play an important role in System Test and Trials. There is the potential of producing standardized components that can be incorporated into an integrated modelling, design, Test and Trials environment. by using high fidelity terrain databases, this same Synthetic Environment can then also be used for Trials planning/preparation and also for Trials data replay and analysis. Synthetic Environments is not an alternative to Trials but together with high fidelity simulations can provide powerful support to the overall System Test and Trials process. The presentation of the paper will include videos showing the use of SE in Trials.
Author
Support Systems; Weapon Systems; Weapons Development; Research and Development; Systems Engineering

20000025613 Defence Evaluation Research Agency, Weapons Systems Sector, Fort Halstead, UK
The Case for 'Joined Up' Testing
Jakins, Gavin A., Defence Evaluation Research Agency, UK; On Trial in the Millennium: UK Guided Weapon Testing Facilities Now and in the Future: Proceedings; 2000, pp. 3.1 - 3.7; In English; See also 20000025611; Copyright; Avail: Issuing Activity

Modelling and Simulation (M&S) are increasingly being used in guided weapon (GW) research and development as an alternative to testing hardware. However, the two techniques are mutually dependent. M&S rely on testing to provide credibility while testing depends on M&S to give it context and to enable facilities to be used cost-effectively. As a result of this interdependency it is argued that it is the combination of M&S and testing which should be viewed as the 'test facility' and which provide for 'Joined-Up' testing.
Author
Weapon Systems; Weapons Development; Research and Development

20000025614 Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn, Germany
A European Approach to Test and Evaluation
Braitinger, M., Industrieanlagen-Betriebsgesellschaft m.b.H., Germany; On Trial in the Millennium: UK Guided Weapon Testing

Facilities Now and in the Future: Proceedings; 2000, pp. 4.1 - 4.6; In English; See also 20000025611; Copyright; Avail: Issuing Activity

With the large number of guided weapons entering the inventory of modern armed forces and the high costs of such weapon systems, there has been a growing awareness of the importance of Test and Evaluation (T&E) during the systems acquisition process. T&E provides the means to reduce development risk, to determine weapon performance, and to demonstrate how well a weapon functions in an operational environment. In most cases the requirements of T&E have an impact on program schedule and costs. The paper briefly outlines the functions and capabilities of the major European test facilities and how they may contribute to guided weapon testing. It also addresses the changes that need to occur within the next few years towards a joint European Test and Evaluation environment.

Author

Weapon Systems; Weapons Development; Research and Development; Test Facilities; Europe

20000025615 Ministry of Defence, London, UK

Towers of Excellence

Everett, A. F., Ministry of Defence, UK; On Trial in the Millennium: UK Guided Weapon Testing Facilities Now and in the Future: Proceedings; 2000, pp. 5.1 - 5.4; In English; See also 20000025611; Copyright; Avail: Issuing Activity

In the SDR White Paper the Government made clear its commitment to a strong and healthy British and European defense industry and a commitment to forces equipped with a decisive technological edge in critical capability areas. In taking forward these policies we must take account of the fact that the defense research budget in the USA is ten or more times that of the UK and about two and a half times as great as that of the whole of the European Union. Figures including both research and development show a broadly similar picture. The ”Towers of Excellence” model is a proposed approach to being selective in a rational way and making the necessary choices in partnership with industry. to introduce the concept it is helpful to begin by considering the two basic reasons that we spend money on defense research.

Derived from text

Defense Industry; Defense Program; Military Technology; Federal Budgets; Governments; Policies

20000025616 British Aerospace Aircraft Group Systems, Waterlooville, UK

Torpedo Testing Facilities

Spencer, C., British Aerospace Aircraft Group Systems, UK; On Trial in the Millennium: UK Guided Weapon Testing Facilities Now and in the Future: Proceedings; 2000, pp. 6.1 - 6.10; In English; See also 20000025611; Copyright; Avail: Issuing Activity

For in-water testing of torpedoes, one of the main assets required is an instrumented Tracking Range. This is used for a wide variety of applications through initial torpedo development, design proving, in-service evaluation and tactical development, and also to provide simulation validation data. Sub-surface tracking of an exercise torpedo is provided by a distributed array of submersible hydrophones, which triangulate the position based on reception of a coded sonar pulse from the torpedo. Similar sonar transponders are attached to submarines and surface vessels to provide tracking. For air launch torpedoes, above-surface tracking is also required. Historically this was provided by radar, however, with the advent of the Global Positioning System, suitable radio transponders are used to transmit the differential GPS position to the tracking base station. This applies to both aircraft and surface vessels. In support of UK torpedo programs, four testing facilities have been used; two fully instrumented fixed tracking ranges for Deep and Shallow water depths, a portable facility (now obsolete) for Very Shallow water depths, and a submarine mounted system, primarily used for ’hitting’ runs. With the end of the cold war the threat emphasis has moved to the littoral environment, and this has necessitated the development of a new Transportable Tracking Range. This paper discusses the facilities required to support further torpedo development, with an emphasis on the use of Tracking Ranges.

Author

Torpedoes; Weapon Systems; Test Facilities

20000025617 Matra BAe Dynamics, Stevenage, UK

Range Selection Issues for the Storm Shadow Programme

King, Anthony Stephen, Matra BAe Dynamics, UK; On Trial in the Millennium: UK Guided Weapon Testing Facilities Now and in the Future: Proceedings; 2000, pp. 7.1 - 7.7; In English; See also 20000025611; Copyright; Avail: Issuing Activity

The Storm Shadow program is a major international guided weapons development program, which presents a number of distinct challenges in the area of trials range selection. In particular, the fact that the program is combined with SCALP EG for the French government, and has no joint government project office, has generated a unique situation. The specific requirements of the two customers and their policy on qualification have influenced the way that the project has approached qualification trials. The major factors that have determined the selection of ground trial facilities and flight trials ranges for the project have been

identified and discussed. These factors are capability, cost, availability, location and management responsibility. The effects of these factors on the program are reviewed and the impact assessed.
Author
Weapon Systems; Weapons Development; Research and Development

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.

20000025427 United Space Boosters, Inc., Cocoa Beach, FL USA
Development of Lead Free Energy Absorber for Space Shuttle Blast Container
Ingram, T., United Space Boosters, Inc., USA; Balles, D., United Space Boosters, Inc., USA; Schricker, A., United Space Boosters, Inc., USA; Novak, H., United Space Boosters, Inc., USA; [1998]; 1p; In English; NASA Technology 2008, 3-5 Nov. 1998, Boston, MA, USA; Sponsored by NASA, USA
Contract(s)/Grant(s): NAS8-36300; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The Space Shuttle vehicle (SSV) is connected to the mobile launch platform (MLP) by four aft skirt hold down studs on each solid rocket booster (SRB). Prior to lift-off, the frangible nuts inside the aft skirt blast containers (BC) are severed into two nut halves by two pyrotechnic booster cartridges. This action releases the SSV and allows the hold down studs to eject through the aft skirt bore and then down into the MLP. USBI has been tasked to upgrade the BC for two specific reasons; 1. to eliminate lead for environmental concerns, and 2. to reduce the chance of nut recontact with the holddown stud. Nut recontact with the stud has been identified as a likely contributor to stud hangups. This upgrade will replace the lead liner with an aluminum foam material. The aluminum foam used as a energy absorber is a proven design in many other aerospace/defense applications. Additional benefits of using the open cell, energy absorbent aluminum foam in place of the solid lead liner are: A. Lead handling/ exposure, and possible contamination, along with hazardous waste disposal will be eliminated; B. Approximately 200 lbs. weight savings will be contributed to each Space Shuttle flight by using aluminum foam over lead; C. The new aluminum liner is designed to catch all shrapnel from frangible nuts thus virtually eliminating chance of foreign object debris (FOD) exiting the HDP, and causing potential damage to the vehicle; D. Potential of using the lighter aluminum liner over lead, allows for easier assembly and disassembly of blast container elements, also allowing for improvements in safety, operator handling, and efficiency of operations. Six BC firing tests will be required to determine if the new liner material will perform in a way to decrease the chance of stud hangups and enhance the ability of the BC to retain blast debris. Testing will be performed at the Kennedy Space Center (KSC) facility known as the Launch Equipment Test Facility (LETF), and will simulate the SRB hold- down post, with actual BC hardware and pyrotechnics assembled, and then test fired. Initial testing was performed in 1997 using a frangible nut in a static drop test over lead and aluminum foam sheet materials. The aluminum foam showed a dramatic improvement of energy absorption over the lead liner material. Proof-of-Principle testing at the KSC-LETF commenced in May, 1998, and is expected to be completed by June, 1998.
Author
Absorbers (Materials); Damage; Metal Foams; Static Tests; Test Firing; Foams

16
SPACE TRANSPORTATION AND SAFETY

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

20000025314 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-99 Flight Day 04 Highlights and Crew Activities Report
Feb. 14, 2000; In English; Videotape: 26 min. 18 sec. playing time, in color, with sound
Report No.(s): BRF-1421D; NONP-NASA-VT-2000022123; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

The primary objective of the STS-99 mission was to complete high resolution mapping of large sections of the Earth's surface using the Shuttle Radar Topography Mission (SRTM), a specially modified radar system. This radar system produced unrivaled

3-D images of the Earth's Surface. The mission was launched at 12:31 on February 11, 2000 onboard the space shuttle Endeavour. and led by Commander Kevin Kregel. The crew was Pilot Dominic L. Pudwill Gorie and Mission Specialists Janet L. Kavandi, Janice E. Voss, Mamoru Mohri from the National Space Development Agency (Japanese Space Agency), and Gerhard P. J. Thiele from DARA (German Space Agency).On the fourth day of the mission the blue team's Dominic Gorie led off the day's tape with a brief memorial to Charles Schultz, as he spoke of some of the vessels that were named for characters in Peanuts, and called to mind the Silver Snoopy, one of the highest awards NASA bestows. Janice Voss answered a couple of questions sent over the internet about a problem with a small thruster on the end of the 200 foot long mast. Mamoru Mohri talks about the EarthKam. Gerhard Thiele and Janet Kavandi describe the process of achieving the digital map of the entire world. At the end of the videotape some of the recently released views from the SRTM are shown. These include shots of the South Island of New Zealand.
CASI
Endeavour (Orbiter); Shuttle Imaging Radar; Space Transportation System; Topography; Spacecrews

20000025320 NASA Kennedy Space Center, Cocoa Beach, FL USA
Debris/Ice/TPS Assessment and Integrated Photographic Analysis of Shuttle Mission STS-103 ***Final Report, 16-29 Dec. 1999***
Katnik, Gregory N., NASA Kennedy Space Center, USA; February 2000; 75p; In English; Original contains color illustrations
Report No.(s): NASA/TM-2000-208564; NAS 1.15:208564; OMRS00UO; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A debris/ice/thermal protection system assessment and integrated photographic analysis was conducted for Shuttle mission STS-103. Debris inspections of the flight elements and launch pad were performed before and after launch. Icing conditions on the External Tank were assessed by the use of computer programs and infrared scanned data during cryogenic loading of the vehicle, followed by on-pad visual inspection. High speed photography of the launch was analyzed to identify ice/debris sources and evaluate potential vehicle damage and/or in-flight anomalies. This report documents the ice/debris/thermal protection system conditions and integrated photographic analysis of Space Shuttle mission STS-103 and the resulting effect on the Space Shuttle Program.
Author
Space Transportation System; Thermal Protection; Space Missions; Ice Formation; High Speed Photography; Debris

20000025326 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-99 Prelaunch Press Briefing
Jan. 30, 2000; In English; Videotape: 12 min. playing time, in color, with sound
Report No.(s): KSC00-00027; NONP-NASA-VT-2000027989; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS

The primary objective of the STS-99 mission was to complete high resolution mapping of large sections of the Earth's surface using the Shuttle Radar Topography Mission (SRTM), a specially modified radar system. This radar system produced unrivaled 3-D images of the Earth's Surface. The mission was launched at 12:31 on February 11, 2000 onboard the space shuttle Endeavour, and led by Commander Kevin Kregel. The crew was Pilot Dominic L. Pudwill Gorie and Mission Specialists Janet L. Kavandi, Janice E. Voss, Mamoru Mohri from the National Space Development Agency (Japanese Space Agency), and Gerhard P. J. Thiele from DARA (German Space Agency). This videotape shows a press briefing about a mechanical problem that the shuttle was having. There was discussion about possibly scrubbing the launch due to the problem with the Enhanced Master Events Controller. A problem with a fuel pump part had also become evident and there was discussion about the impact that this could have on the flight.
CASI
Endeavour (Orbiter); Space Transportation System; Preflight Operations; Prelaunch Problems; Spacecraft Reliability

20000025327 NASA Kennedy Space Center, Cocoa Beach, FL USA
Astronaut Mamoru Mohri Leaves Patrick Air Base After the Scrub of STS-99 Due to Mechanical Failure
Feb. 02, 2000; In English; Videotape: 5 min. playing time, in color, with sound
Report No.(s): KSC00-00029; NONP-NASA-VT-2000027982; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS

The primary objective of the STS-99 mission was to complete high resolution mapping of large sections of the Earth's surface using the Shuttle Radar Topography Mission (SRTM), a specially modified radar system. This radar system produced unrivaled 3-D images of the Earth's Surface. The mission was launched at 12:31 on February 11, 2000 onboard the space shuttle Endeavour, and led by Commander Kevin Kregel. The crew was Pilot Dominic L. Pudwill Gorie and Mission Specialists Janet L. Kavandi,

Janice E. Voss, Mamoru Mohri from the National Space Development Agency (Japanese Space Agency), and Gerhard P. J. Thiele from DARA (German Space Agency). This videotape shows Mamoru Mohri boarding a plane at Patrick Air Base after the scrub of the mission due to mechanical problems. Prior to his departure, he answers a few questions from members of the Japanese press who had gathered for his departure.
CASI
Astronauts; Endeavour (Orbiter); Space Transportation System; Spacecrews

20000025328 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-99 Crew with Press, TCDT Crew Emergency Egress Training, Walkdown Pad 39A
Jan. 13, 2000; In English; Videotape: 12 min. playing time, in color, with sound
Report No.(s): KSC00-00009; NONP-NASA-VT-2000027979; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS

The primary objective of the STS-99 mission was to complete high resolution mapping of large sections of the Earth's surface using the Shuttle Radar Topography Mission (SRTM), a specially modified radar system. This radar system produced unrivaled 3-D images of the Earth's Surface. The mission was launched at 12:31 on February 11, 2000 onboard the space shuttle Endeavour. and led by Commander Kevin Kregel. The crew was Pilot Dominic L. Pudwill Gorie and Mission Specialists Janet L. Kavandi, Janice E. Voss, Mamoru Mohri from the National Space Development Agency (Japanese Space Agency), and Gerhard P. J. Thiele from DARA (German Space Agency). In this tape Commander Kevin Kregel introduces the crew to the assembled press at the site where they will practice emergency exit procedures as part of the Terminal Countdown Demonstration Test (TCDT), a dress rehearsal for launch.
CASI
Space Transportation System; Spacecrews; Preflight Operations; Crew Procedures (Preflight); Prelaunch Tests; Astronauts

20000025450 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-99 Crew Activities Report / Flight Day 09 Highlights
Feb. 20, 2000; In English; Videotape: 28 min. 52 sec. playing time, in color, with sound
Report No.(s): BRF-1421I; NONP-NASA-VT-2000022263; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

The primary objective of the STS-99 mission was to complete high resolution mapping of large sections of the Earth's surface using the Shuttle Radar Topography Mission (SRTM), a specially modified radar system. This radar system produced unrivaled 3-D images of the Earth's Surface. The mission was launched at 12:31 on February 11, 2000 onboard the space shuttle Endeavour, and led by Commander Kevin Kregel. The crew was Pilot Dominic L. Pudwill Gorie and Mission Specialists Janet L. Kavandi, Janice E. Voss, Mamoru Mohri from the National Space Development Agency (Japanese Space Agency), and Gerhard P. J. Thiele from DARA (German Space Agency). This tape shows the activities of the ninth day of the mission. The announcement of the decision to extend the SRTM for 9 hours is made to the crew. This means that almost all (i.e., 99.9 %) of the target area of the Earth will be imaged, at least once. Some shots of the 200 foot long mast where the outboard antennas are located are shown. Mamoru Mohri is shown changing a data tape, while he explains the rationale for recording rather than transmitting the data. Gerhard Thiele speaks to the German press. At the end of this tape are images generated from the SRTM. There are views of Oahu, Molokai, Lanai and west Maui, Hawaii; Dallas, Texas; Salalah, Oman; and Tasmania, Australia. Animations showing the topography around Hokkaido, Japan and Brazil are also shown.
CASI
High Resolution; Shuttle Imaging Radar; Space Transportation System; Spacecrews; Topography

20000025466 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-99 Crew Arrives for Second Launch Attempt, SRTM Mission, Endeavour
Feb. 07, 2000; In English; Videotape: 5 min. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000027995; KSC00-00031; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS

The primary objective of the STS-99 mission was to complete high resolution mapping of large sections of the Earth's surface using the Shuttle Radar Topography Mission (SRTM), a specially modified radar system. This radar system produced unrivaled 3-D images of the Earth's Surface. The mission was launched at 12:31 on February 11, 2000 onboard the space shuttle Endeavour, and led by Commander Kevin Kregel. The crew was Pilot Dominic L. Pudwill Gorie and Mission Specialists Janet L. Kavandi, Janice E. Voss, Mamoru Mohri from the National Space Development Agency (Japanese Space Agency), and Gerhard P. J. Thiele from DARA (German Space Agency). This tape shows the arrival of the crew at the Kennedy Space Center for a second attempt

to launch. The first attempt was scrubbed due to mechanical problems. The crew is introduced to the press by Commander Kregel. Mamoru Mohri speaks to the press in English and Japanese and Gerhard Thiele makes a brief statement in German.
CASI
Space Transportation System; Spacecrews; Astronauts; Crew Procedures (Preflight)

20000025467 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-99 Commander and Pilot for the SRTM Mission, Practice Flight in the Shuttle Training Aircraft
Feb. 09, 2000; In English; Videotape: 5 min. playing time, in color, with sound
Report No.(s): KSC00-00037; NONP-NASA-VT-2000027978; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS

The primary objective of the STS-99 mission was to complete high resolution mapping of large sections of the Earth's surface using the Shuttle Radar Topography Mission (SRTM), a specially modified radar system. This radar system produced unrivaled 3-D images of the Earth's Surface. The mission was launched at 12:31 on February 11, 2000 onboard the space shuttle Endeavour, and led by Commander Kevin Kregel. The crew was Pilot Dominic L. Pudwill Gorie and Mission Specialists Janet L. Kavandi, Janice E. Voss, Mamoru Mohri from the National Space Development Agency (Japanese Space Agency), and Gerhard P. J. Thiele from DARA (German Space Agency). This tape shows Commander Kregel and Pilot Gorie getting on board the Shuttle Training Aircraft and practicing approaches for the shuttle landing.
CASI
Spacecrews; Training Aircraft; Crew Procedures (Preflight); Horizontal Spacecraft Landing

20000025543 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-99 SRTM Moved from the SSPF to the OPF #2
Jul. 21, 1999; In English; Videotape: 10 min. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000027994; KSC99-90182; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS

Live footage shows the move of the Shuttle Radar Topography Mission (SRTM) system from the Space Station Processing Facility (SSPF) to the Orbiter Processing Facility (OPF).
CASI
Shuttle Imaging Radar; Radar Imagery; Radar Maps; Relief Maps; Topography; Earth Surface

20000025544 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-99 Lift and Mate to External Tank in VAB, Endeavour, SRTM Mission
Dec. 03, 1999; In English; Videotape: 9 min. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000027992; KSC99-90280; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS

Live footage shows the lifting of the external tank to the Endeavour orbiter system of STS-99 in the Vehicle Assembly Building (VAB).
CASI
Space Transportation System; Space Transportation System Flights; Endeavour (Orbiter)

20000025577 NASA Kennedy Space Center, Cocoa Beach, FL USA
TCDT STS-99 Crew at FSS/White Room
Jan. 14, 2000; In English; Videotape: 11 min. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000027991; KSC00-00008; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS

Live footage shows the crewmembers of STS-99, Commander Kevin R. Kregel, Pilot Dominic L. Pudwill Gorie, Mission Specialists Janet L. Kavandi, Janice E. Voss, Mamoru Mohri, and Gerhard P.J. Thiele, putting on equipment for ingress training.
CASI
Astronaut Training; Ingress (Spacecraft Passageway); Spacecrews; Crew Procedures (Preflight)

20000025957 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-99 Countdown Status Briefing
Feb. 08, 2000; In English; Videotape: 23 min., 26 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000027977; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

The primary objective of the STS-99 mission was to complete high resolution mapping of large sections of the Earth's surface using the Shuttle Radar Topography Mission (SRTM), a specially modified radar system. This radar system produced unrivaled 3-D images of the Earth's Surface. The mission was launched at 12:31 on February 11, 2000 onboard the space shuttle Endeavour. This tape presents a pre-launch briefing for the press held on Feb 8, 2000. Statements were given by Doug Lyons, Shuttle Test Director; Scott Higginbotham, STS-99 Payload Director and Ed Priselac, Shuttle Weather Officer. Mr. Lyons reported on the replacement of the Master Control Unit on board Endeavour, the part that had caused a delay in the launch. He reviewed the work that had to be done and the timeline for completion. Scott Higginbotham reported that there were no problems with the SRTM. Ed Priselac reported on favorable weather conditions for the launch. Discussion after the statements concerned a possible problem with a cable, and the possibility of a further delay to the launch.
CASI
Countdown; Endeavour (Orbiter); Launching; Prelaunch Summaries; Prelaunch Problems; Prelaunch Tests

20000025958 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-99 Countdown Status Briefing
Feb. 08, 2000; In English; Videotape: 27 min., 27 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000025575; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS
The primary objective of the STS-99 mission was to complete high resolution mapping of large sections of the Earth's surface using the Shuttle Radar Topography Mission (SRTM), a specially modified radar system. This radar system produced unrivaled 3-D images of the Earth's Surface. The mission was launched at 12:31 on February 11, 2000 onboard the space shuttle Endeavour. This tape presents a pre-launch briefing for the press held on Jan. 28, 2000. Statements were given by Doug Lyons, Shuttle Test Director; Scott Higginbotham, STS-99 Payload Director and Ed Priselac, Shuttle Weather Officer. Doug Lyons reported on the checkout of the equipment. Scott Higgenbotham reviewed the steps required to assemble and test the SRTM instrumentation and equipment. Ed Priselac gave the weather forecast for the expected launch day. The questions concerned a possible problem with a part onboard the shuttle and the likely impact this might have on the launch.
CASI
Countdown; Endeavour (Orbiter); Launching; Prelaunch Summaries; Prelaunch Tests; Prelaunch Problems

20000026827 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-99 Countdown Status Briefing
Feb. 09, 2000; In English; Videotape: 19 min. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000027993; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS
Live footage shows the participants in the Press Conference disclosing the status of the STS-99 flight. The panelists consists of NASA's test Director Steve Altemus, the STS-99 Payload Manager Scott Higginbotham, and the Shuttle Weather Officer Ed Priselac. Joel Wells NASA's Public Affairs introduces each panelist as they discuss the problems with the left hand ignition cable, the potential change of the GPS receiver, payload status, and favorable weather conditions. The panel members also answered questions from members of the audience. Also shown are various shots of the Shuttle on the launch pad.
CASI
Conferences; Countdown; Spacecraft Launching; Checkout; Spacecraft Maintenance; Ignition; Cables (Ropes); Global Positioning System; Receivers; Weather

20000026828 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-99 Countdown Status Press Conference
Feb. 10, 2000; In English; Videotape: 10 min. 40 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000027981; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS
Live footage shows the participants in the Press Conference disclosing the status of the STS-99 flight. The panelists consists of NASA's test Director Jeff Spaulding, the STS-99 Payload Manager Scott Higginbotham, and the Shuttle Weather Officer Ed Priselac. Bruce Buckingham NASA's Public Affairs introduces each panelist as they discuss the servicing of fuel tanks, checkout, closeouts, payload status, and favorable weather conditions. The panelists also answer questions from the audience. Also shown are various shots of the Shuttle on the launch pad.
CASI
Conferences; Checkout; Fuel Tanks; Countdown; Spacecraft Launching; Weather

20000026829 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-99 Crew News Conference/ESA Call Flight Day 8
Feb. 18, 2000; In English; Videotape: 26 min. 51 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000025577; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

Live footage shows the crewmembers of STS-99, Commander Kevin R. Kregel, Pilot Dominic L. Pudwill Gorie, Mission Specialists Janet L. Kavandi, Janice E. Voss, Mamoru Mohri, and Gerhard P.J. Thiele, participating in a press conference. The crew answer questions from U.S and Japanese reporters at various NASA Centers, and Headquarters. Discussions include the nitrogen gas line problem, the deployment of the mass, and what would happen if the mass has to be jettisoned. Thiele, Kregel, Kavandi and Voss also answer questions from German Research Minister Edelgard Buhlmann. The NASA Administrator Daniel Goldin along with Buhlmann also congratulates the crew on the success of the mission and the potential benefits of the resulting high-resolution maps.
CASI
Conferences; Teleconferencing; Video Communication

20000027405 Space Transportation Association, Artlington, VA USA
Some Implications of Space Tourism for Extraterrestrial Resources
Rogers, T. F., Space Transportation Association, USA; Space Resources Utilization Roundtable; 1999, pp. 29-30; In English; See also 20000027384; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The Purpose and Scope of the Roundtable ”to bring together people with ideas about what will be useful products in the space environment with those who know how to produce materials on Earth.” When considering extraterrestrial resources in the context of their use in support of general public space tourism it is important to broaden this definition of Scope in certain ways. The first stages of extraterrestrial space tourism will probably take place in the Earth’s lower atmosphere - far from the Moon or the planets, and even well below Earth orbit. Sophisticated aircraft could take tourists up to altitudes approaching 20 miles for short periods. and the earliest of fully reusable space transportation vehicles should be able to reach some 50 miles in altitude for short trips. Later, Earth multi-orbit trips could be offered, to be followed by stays in residence in LEO hotels for days. In time, trips could take place to/from the Moon, eventually with stays there. It should be appreciated that there are two most important extraterrestrial resources immediately available for space tourism use. They are not ”materials” or ”products,” but are two vital space ”resource intangibles”: 1) The resource of Perspective: At high altitudes and in orbit, people could see the natural and man-made physical characteristics of the Earth and its atmosphere from a wholly new perspective. Too, they could view the cosmos with extraordinary clarity. In Lunar circumnavigational trips, they could view extraordinary terrain and, in stays there, do so in great detail. 2) The resource of Microgavity: Reductions in, and even the near absence of, the local force of gravity would allow people to experience and do things in extraterrestrial circumstances that cannot be experienced or done at the Earth’s surface. For instance, all earthly athletic records will ”be out the window.” Imagine the ”Space Olympics” broad jump and pole-vault records to be set in LEO. And playing tennis and golf on the Lunar surface.
Derived from text
Extraterrestrial Resources; Space Tourism; Aerospace Environments; Earth Atmosphere

20000027502 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-39 Compiled Orbiter Footage
Apr. 07, 1991; In English; Videotape: 25 min. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000013423; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

Live footage shows the rollback of STS-39 to the VAB (Vehicle Assembly Building), the rollback of Discovery to the OPF (Orbiter Processing Facility) High Bay 2, Discovery ET Disconnect Door Hinges (Cracks), Discovery ET Disconnect Door Hinges (Edited) and Discovery in the VAB.
CASI
Discovery (Orbiter); Space Transportation System; Space Transportation System Flights; Spacecraft Maintenance

20000027507 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-99 CEIT at the OPF High Bay-2, Endeavour, SRTM Mission
Jul. 28, 1999; In English; Videotape: 7 min. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000027990; KSC99-90191; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS

Live footage shows the crewmembers of STS-99, Commander Kevin R. Kregel, Pilot Dominic L. Pudwill Gorie, Mission Specialists Janet L. Kavandi, Janice E. Voss, Mamoru Mohri, and Gerhard P.J. Thiele, participating in Crew Equipment Interface Test (CEIT) activities at the Orbiter Processing Facility (OPF). The crew is shown checking out and learning about the equipment.
CASI
Astronaut Training; Spacecraft Equipment; Onboard Equipment; Crew Procedures (Preflight); Preflight Operations

20000027508 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-99 Flight Crew Post-Landing Press Conference
Feb. 23, 2000; In English; Videotape: 35 min. 5 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000025580; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS
The primary objective of the STS-99 mission was to complete high resolution mapping of large sections of the Earth's surface using the Shuttle Radar Topography Mission (SRTM), a specially modified radar system that will produced unrivaled 3-D images of the Earth's Surface. The mission was launched at 12:31 on February 11, 2000 onboard the space shuttle Endeavour. The mission was led by Commander Kevin Kregel. The crew was Pilot Dominic L. Pudwill Gorie and Mission Specialists Janet L. Kavandi, Janice E. Voss, Mamoru Mohri, the National Space Development Agency (Japanese Space Agency) and Gerhard P. J. Thiele, from DARA (German Space Agency). The shuttle landed at Kennedy on the February 22, 2000 at 5:22 CST. This tape shows a post landing press conference with the crew. Commander Kregel made a brief statement praising the crew for the mission's success and then introduced the crewmembers. The crew answered questions about the retraction of the mast. The retraction had been successful, but the latches to the canister had failed. The extreme cold may have caused the problem and a solution was proposed from ground control. If this had not worked, an EVA would have been required. The astronauts were confident in the solution to the problem, however they were ready to perform any required EVA. Mamoru Mohri answered questions from the Japanese press, speaking in English and Japanese.
CASI
Astronauts; Shuttle Imaging Radar; Space Transportation System; Space Transportation System Flights; Spacecrews

20000027606 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-99 Pre-Launch Press Conference
Jan. 29, 2000; In English; Videotape: 49 min. 34 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000025581; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS
Live footage shows the participants in the Pre-Launch Press Conference disclosing the status of the STS-99 flight. The panelists consists of Ron Dittemore the Shuttle Program Manager from JSC (Johnson Space Center), Dave King Director of Shuttle Operation from KSC (Kennedy Space Center), Klaus Damian Head of ESA Astronaut Training Division, and Capt. Clif Stargardt Meteorologist 45th Weather Squadron. George Diller, NASA's Public Affairs Office, introduces each panelist as they discuss the failure of a segment of the tip seal, the international contributions made to this mission, and the weather condition. The panelists also answer questions from the audience about the rejected component of the tip seal, how this error was made, and the effects that this has on the flight plans. Also shown are various night shots of the Shuttle on the launch pad.
CASI
Prelaunch Summaries; Spacecraft Launching; Mission Planning; Prelaunch Problems; Spacecraft Reliability; Component Reliability; Quality Control; Spacecraft Maintenance; Prelaunch Tests

20000027607 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-99 Post-Launch Press Conference
Feb. 11, 2000; In English; Videotape: 33 min. 5 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000025578; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS
Live footage shows the participants in the Post-Launch Press Conference disclosing the status of the STS-99 flight. The panelists consist of Bill Gerstenmaier, Acting Manager of Launch Integration and Dave King, Director of Shuttle Operations at KSC (Kennedy Space Center). Joel Wells, of NASA's Public Affairs Office, introduces each panelist as they discuss the mapping to the Earth, and improve safety of the shuttle. The panelists also answer questions from the audience about the countdown. Also shown are various shots of the Shuttle on the launch pad.
CASI
Spacecraft Launching; Postlaunch Reports; Conferences; Shuttle Imaging Radar; Radar Imagery; Topography; Earth Surface; Flight Safety

20000027608 NASA Kennedy Space Center, Cocoa Beach, FL USA

STS-99 Countdown Status Briefing

Jan. 29, 2000; In English; Videotape: 21 min. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2000025576; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

The primary objective of the STS-99 mission was to complete high resolution mapping of large sections of the Earth's surface using the Shuttle Radar Topography Mission (SRTM), a specially modified radar system. This radar system produced unrivaled 3-D images of the Earth's Surface. The mission was launched at 12:31 on February 11, 2000 onboard the space shuttle Endeavour. This tape shows a pre-launch briefing. The panel members are George Diller, NASA Public Affairs; Scott Higginbotham, SRTM Payload Manager; Steve Altemus, NASA Test Director; and Ed Priselac, Meteorologist. The briefing opens with an announcement by Mr Diller that there were no further developments with the engine problems, and requests that questions about that issue be held for another press briefing. Steve Altemus summarized the situation and the steps to be taken. Scott Higginbotham reported that there were no problems with the mission hardware. Ed Priselac reported favorable weather for tanking and launch, and at emergency landing sites.

CASI

Endeavour (Orbiter); Launching; Shuttle Imaging Radar; Space Transportation System

20000027609 NASA Kennedy Space Center, Cocoa Beach, FL USA

STS-99 / Endeavour SRTM Science Briefing and Applications from JSC

Jan. 21, 2000; In English; Videotape: 1 hr. 24 min. 10 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2000025574; No Copyright; Avail: CASI; B04, Videotape-Beta; V04, Videotape-VHS

The primary objective of the STS-99 mission was to complete high resolution mapping of large sections of the Earth's surface using the Shuttle Radar Topography Mission (SRTM), a specially modified radar system. This radar system produced unrivaled 3-D images of the Earth's Surface. This videotape shows a science press briefing. The panel members are Michael Kobrick, the SRTM Project Scientist at JPL; Thomas Henning, SRTM Program Manager at the National Imagery and Mapping Agency; Diane Evans, the Director of the Earth Sciences Program at NASA; and Marian Werner, XSAR Project Manager for the DLR, Deutschen Zentrum fur Luft- und Raumfahrt, Germany's National Aerospace Research Center. Michael Kobrick explained the mechanics of interferometric measurements of the Earth. He explained and demonstrated with a scale model the deployable mast's use. He also explained the importance of the attitude and orbit determination avionics. A brief animated video showing how four beams would give a 225 km wide swath of the Earth topography was viewed. Thomas Henning discussed some of the usage of the digital terrain elevation data for flood relief planning, cell phone station placement, military planning for command and control centers, and flight simulation. He explained that public access to the most precise data would be limited. Diane Evans described data usage in flood prediction, earthquake fault identification and archeology. Marian Werner described the German and Italian input to the project. The questions from the press concerned the time to process this data, and the reasons for the limited access to the more precise data.

CASI

Digital Data; Earth Sciences; High Resolution; Shuttle Imaging Radar; Space Transportation System; Terrain; Topography; Satellite Observation; Remote Sensing; Radar Geology; Radar Imagery; Space Shuttle Payloads

20000027612 NASA Kennedy Space Center, Cocoa Beach, FL USA

STS-99 / Endeavour Pre Launch Press Conference

Feb. 09, 2000; In English; Videotape: 34 min. 54 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2000033844; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS

Live footage shows the participants in the Pre Launch Press Conference disclosing the status of the STS-99 flight. The panelists consists of Ron Dittemore the Shuttle Program Manager from JSC (Johnson Space Center), Dave King Director of Shuttle Processing from KSC (Kennedy Space Center), and Capt. Clif Stargardt Meteorologist 45th Weather Squadron. George Diller NASA's Public Affairs Office introduces each panelist as they discuss the hardware change, re-test, and the weather condition. The panelists also answer questions from the audience about the GPS box that failed early that morning, the deployment of the mass, and vehicle safety today as it compares to the past. Also shown are various shots of the Shuttle on the launch pad.

CASI

Prelaunch Summaries; Spacecraft Launching; Conferences; Hardware; Prelaunch Tests; Weather; Flight Plans

20000027618 NASA Kennedy Space Center, Cocoa Beach, FL USA

STS-99 / Endeavour Mission Overview

Jan. 30, 2000; In English; Videotape: 1 hr. 7 min. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2000025572; No Copyright; Avail: CASI; B04, Videotape-Beta; V04, Videotape-VHS

The primary objective of the STS-99 mission was to complete high resolution mapping of large sections of the Earth's surface using the Shuttle Radar Topography Mission (SRTM). This radar system will produce unrivaled 3-D images of the Earth's Surface. This videotape presents a mission overview press briefing. The panel members are Dr. Ghassem Asrar, NASA Associate Administrator Earth Sciences; General James C. King, Director National Imagery and Mapping Agency (NIMA); Professor Achim Bachem, Member of the Executive Board, Deutschen Zentrum fur Luft- und Raumfahrt (DLR), the German National Aerospace Research Center; and Professor Sergio Deiulio, President of the Italian Space Agency. Dr. Asrar opened with a summary of the history of Earth Observations from space, relating the SRTM to this history. This mission, due to cost and complexity, required partnership with other agencies and nations, and the active participation of the astronauts. General King spoke to the expectations of NIMA, and the use of the Synthetic Aperture Radar to produce the high resolution topographic images. Dr. Achim Bachem spoke about the international cooperation that this mission required, and some of the commercial applications and companies that will use this data. Dr Deiulio spoke of future plans to improve knowledge of the Earth using satellites. Questions from the press concerned use of the information for military actions, the reason for the restriction on access to the higher resolution data, the mechanism to acquire that data for scientific research, and the cost sharing from the mission's partners. There was also discussion about the mission's length.

CASI

International Cooperation; Shuttle Imaging Radar; Earth Observations (From Space); Topography

17
SPACE COMMUNICATIONS, SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

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

20000027566 NASA Goddard Space Flight Center, Greenbelt, MD USA

Pre-Flight Testing of Spaceborne GPS Receivers Using a GPS Constellation Simulator

Kizhner, Semion, NASA Goddard Space Flight Center, USA; Alonso, Roberto, National Commission of Space Activities, Argentina; 1999; In English; ION GPS 1999, 14-17 Spe. 1999, Nashville, TN, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

The NASA Goddard Space Flight Center (GSFC) Global Positioning System (GPS) test facility has been established within the GSFC Guidance Navigation and Control Center. The GPS test facility is currently housing the STR2760 GPS satellite 40-channel attitude simulator and an STR4760 12-channel navigation simulator. The facility also contains a few other Goddard resources such as an atomic time standard test bed, a rooftop antenna platform and a radome. It provides a new capability of high dynamics GPS simulations for space flight that is unique within the aerospace community. The GPS facility gives a significant advantage in the development and support of GPS based technologies for position, attitude and precise time determination on-board a spacecraft, sounding rocket or balloon. The GPS simulator system is configured in a transportable rack and is available for GPS applications' component development as well as for spacecraft subsystem and system level testing at spacecraft integration and test sites. The GPS facility has been operational since early 1996 and has been already utilized by a few successful flight projects carrying GPS experiments, such as USA Seastar satellite and the first Argentine satellite SAC-A. The experience in the SAC-A pre-flight testing using the STR2760 simulator is summarized as well as the comparison with preliminary analysis of the GPS data from SAC-A telemetry.

Author

Flight Tests; Guidance (Motion); Navigation; Radomes; Simulation; Simulators; Test Facilities

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SPACECRAFT DESIGN, TESTING AND PERFORMANCE

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

20000025391 Rocket Space Corp. Energia, Korlev, Russia

Two-Phase Central Thermal Control System (TPS) of International Space Station ALPHA Russian Segment

Grigoriev, Y. I., Rocket Space Corp. Energia, Russia; Cykhyotsky, V. M., Rocket Space Corp. Energia, Russia; Sementsov, A. N., Rocket Space Corp. Energia, Russia; Prokhorov, Y. M., Rocket Space Corp. Energia, Russia; Gorbenko, G. A., Kharkov Inst. of Aviation, Ukraine; Malukhin, C. A., Kharkov Inst. of Aviation, Ukraine; Ninth Thermal and Fluids Analysis Workshop Proceedings; November 1999, pp. 69-80; In English; See also 20000025387; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

International Space Station ALPHA Russian Segment (ISSA RS) will present an assembly of many modules with total heat load up to 30 kilowatts. Collection, transport and rejection of heat in outer space will be provided by Central Thermal Control System (TPS). The TPS is being designed and built by Rocket-Space Corporation ”ENERGIA” (Russia). The TPS design concept is commonly referred to as a ”thermal bus” concept, when single-phase thermal control systems of individual modules are connected with central TPS through Evaporative Heat Exchangers (EHEX). Pump forces liquid coolant to pressure line, where it is fed to evaporative heat exchangers through actively controlled Flow Control Valves (FCV) if necessary. FCV maintains high ammonia vapor quality at the EHEX exit. Vapor gets condensed in condensers of heat pipe-based Central Heat Exchanger-Radiator (RAD). Then, heat is distributed all over the RAD due to heat pipes. Heat Controlled Accumulator (HCA) maintains nearly constant pressure in vapor line. TPS has a number of auxiliary elements: Electric Heater (EH) in pressure line prevents the system from low temperatures under low heat loads, the Heat Exchanger-Regenerator (RHEX) heats up liquid ammonia entering the HCA, Separator (S), non- condensable gas trap, a number of flow control valves. To maintain proper thermal regime of the station some control methods of the TPS elements have been suggested. Namely, how to control FCV operation, RAD panel rotation, Electric Heater on/off turning and bypass valves operation. Results of mathematical modeling and experimental investigations carried out in the Center of Technical Physics of Kharkov Aviation Institute (CEP KhAI) (Ukraine) are presented. It is proved the TPS Parameters Control System designed to be reliable.
Author

International Space Station; Temperature Control; Heat Exchangers; Two Phase Flow; Accumulators

20000025395 Construcciones Aeronauticas S.A., Madrid, Spain

A Stochastic Approach to Spacecrafts Thermal Analysis

Herrera, Felix Lamela, Construcciones Aeronauticas S.A., Spain; Simavilla, Ana Laveron, Insituto Univ. ”Ignacio da Riva”, Spain; Ninth Thermal and Fluids Analysis Workshop Proceedings; November 1999, pp. 117-129; In English; See also 20000025387; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Thermal design of spacecraft’s is commonly undertaken by means of analysis tools based on deterministic methodology. However great benefits can be obtained when Stochastic Analysis, and Monte Carlo Simulation in particular, is implemented in an integral approach with the existing codes used to run conventional spacecraft thermal analysis. Scatter, or uncertainty, is present everywhere in engineering so that it is essential not only to build up a detailed physically representative model, but also consider one additional important component, which is the scatter in parameter governing the analytical response. In this light, a European Consortium under the leadership of CASA-Space Division has developed the PROMENVIR code which is an advanced Meta-Computing tool for performing, stochastic analysis of ceneric physical systems. PROMENVIR is the result of a research project partially founded by the European Commission within the Fourth Framework of the ESPRIT program. Several Companies coming from different industrial areas (automotive, aerospace, energy) has participated in its development and have actively contributed to present a final product which meets the main performances required by the end industrial users of different disciplines. PROMENVIR is a code based in Monte Carlo Simulation what imply numerous advantages when compared to other classical approaches. e.g. no limitation as to the type of analysis (linear. non-linear, etc.), no limitation as to the amount of scatter in the parameters, any solver may be used, learning new codes is not needed since Montecarlo Simulation allows practically painless accommodation to any solver in the market. It must also be emphasized that PROMENVIR is not a product conceived

for a specific engineering, application, but it can be used in different areas, such as Structural Analysis, Thermal Control and Fluid Mechanics.
Derived from text
Stochastic Processes; Monte Carlo Method; Thermal Analysis; Applications Programs (Computers); Scientific Satellites

20000025437 NASA Marshall Space Flight Center, Huntsville, AL USA
The TSS-1R Electrodynamic Tether Experiment: Scientific and Technological Results
Stone, Nobie H., NASA Marshall Space Flight Center, USA; Raitt, John, Utah State Univ., USA; [1998]; 1p; In English, 18 Jul. 1998, Japan; Sponsored by Committee on Space Research; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The bi-national, US-Italian, Tethered Satellite System (TSS) program was designed to provide a unique opportunity to explore certain space plasma- electrodynamic processes and the orbital mechanics of a gravity-gradient stabilized system of two satellites linked by a long conducting tether. The second flight, TSS-LR, was launched February 22, 1996 on STS-75 and satellite deployment began at MET 3/00:27. A unique data set was obtained over the next five hours, as the tether was deployed to a length of 19695 meters, which has allowed significant science to be accomplished. This presentation will focus on electrodynamic processes generated by the tether--in particular, the collection of electrical current from the ionospheric plasma. of particular significance is an apparent transition of the physics of current collection when the potential of the collecting body becomes greater than the ram energy of the ionospheric atomic oxygen ions. Previous theoretical models of current collection were electrostatic--assuming that the orbital motion of the system, which is highly subsonic with respect to electron thermal motion, was un- important. This may still be acceptable for the case of relatively slow-moving sounding rockets. However, the TSS-LR results show that motion relative to the plasma must be accounted for in orbiting systems.
Author
Experimentation; Data Acquisition; Tethering; Electrodynamics; Plasmas (Physics); Particle Motion; Mathematical Models

20000025483 NASA Langley Research Center, Hampton, VA USA
Liberty Bell 7 Recovery Evaluation and Nondestructive Testing
Madaras, Eric I., NASA Langley Research Center, USA; Smith, William L., NASA Langley Research Center, USA; December 1999; 14p; In English; Original contains color illustrations
Contract(s)/Grant(s): RTOP 953-20-00-01
Report No.(s): NASA/TM-1999-209824; NAS 1.15:209824; L-17942; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An inspection of the Mercury capsule, Liberty Bell 7, and its contents was made on September 1 and 2, 1999. The condition of the capsule and its contents was consistent with long-term exposure to salt water and high pressures at the bottom of the ocean. Many of the metallic materials suffered corrosion, whereas the polymer-based materials seem to have survived remarkably well. No identifiable items or structures were found that appeared to have any scientific value. At this time, no further nondestructive evaluation appears to be justified.
Author
Mercury Spacecraft; Nondestructive Tests

20000025541 FDC/NYMA, Inc., Hampton, VA USA
International Space Station Evolution Data Book, Volume 2, Evolution
Jorensen, Catherine A., Editor, FDC/NYMA, Inc., USA; November 1999; 82p; In English
Contract(s)/Grant(s): NAS1-96013
Report No.(s): NASA/SP-1999-6109/VOL2; NAS 1.21:6109/VOL2; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This document provides a focused and in-depth look at the opportunities and drivers for the enhancement and evolution of the International Space Station (ISS) during its assembly and until its assembly complete (AC) stage. These enhancements would expand and improve the current baseline capabilities of the ISS and help to facilitate the commercialization of the ISS by the private sector. The intended users of this document include the ISS organization, the research community, other NASA programs and activities, and the commercial sector interested in opportunities that the ISS offers. The purpose of this document is threefold. First, it provides a broad integrated systems view of the current baseline design of the ISS systems and identifies potential growth and limitations of these systems. Second, it presents current and future options for the application of advanced technologies to these systems and discusses the impacts these enhancements may have on interrelated systems. Third, it provides this information in a consolidated format to research and commercial entities to help generate ideas and options for developing or implementing

new technologies to expand the current capabilities of ISS and to assist them in determining potential beneficial uses of the ISS. The content of this document ventures beyond the current designs and capabilities of the ISS towards its future potential as a unique research platform and engineering test bed for advanced technology. It provides an initial source of information to help.stimulate the government and private sectors to develop a technological partnership in support of the evolution and commercialization of the ISS.
Derived from text
Augmentation; Increasing; Evolution (Development); International Space Station; Space Station Structures; Structural Design; Design Analysis

20000027428 Rotary Rocket Co., San Bruno, CA USA
Preliminary Flight Test of the Roton ATV
Binnie, Brian, Rotary Rocket Co., USA; 1999 Report to the Aerospace Profession: Forty Third Symposium Proceedings; September 1999, pp. 194-204; In English; See also 20000027414; Copyright; Avail: Issuing Activity
The Roton is a uniquely configured,pilot space vehicle designed to provide reusable, single stage to orbit (SSTO) capabilities. Like most rockets, it is launched vertically, but unlike other designs, it also lands vertically - under the assistance of a rotor recovery system. The Roton ATV (Atmospheric Test Vehicle) is a full-scale, landing and approach, demonstrator vehicle. The flight test program of the ATV is designed to examine the handling qualities of the vehicle and validate its performance in the approach and landing phase of the Roton's operational profile.
Derived from text
Flight Tests; Ground Tests; Single Stage to Orbit Vehicles; Test Vehicles; Launch Vehicles; Single Stage Rocket Vehicles; Spacecraft Design

20000027509 NASA Langley Research Center, Hampton, VA USA
Dynamic Stability Testing of the Genesis Sample Return Capsule
Cheatwood, F. McNeil, NASA Langley Research Center, USA; Winchenbach, Gerald L., Air Force Research Lab., USA; Hathaway, Wayne, Arrow Tech Associates, Inc., USA; Chapman, Gary, Aerospace Computing, Inc., USA; [2000]; 10p; In English; 38th; 38th Aerospace Sciences Meeting, 10-13 Jan. 2000, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-1009; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche
This paper documents a series of free flight tests of a scale model of the Genesis Sample Return Capsule. These tests were conducted in the Aeroballistic Research Facility (ARF), located at Eglin AFB, FL, during April 1999 and were sponsored by NASA Langley Research Center. Because these blunt atmospheric entry shapes tend to experience small angle of attack dynamic instabilities (frequently leading to limit cycle motions), the primary purpose of the present tests was to determine the dynamic stability characteristics of the Genesis configuration. The tests were conducted over a Mach number range of 1.0 to 4.5. The results for this configuration indicate that the models were dynamically unstable at low angles of attack for all Mach numbers tested. At Mach numbers below 2.5, the models were also unstable at the higher angles of attack (above 15 deg), and motion amplitudes of up to 40 deg were experienced. Above Mach 2.5, the models were dynamically stable at the higher angles of attack.
Author
Dynamic Stability; Genesis Mission; Space Capsules; Flight Stability Tests

19
SPACECRAFT INSTRUMENTATION AND ASTRIONICS

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

20000025392 Northrop Grumman Corp., Baltimore, MD USA
Thermal Control of a 195 Kelvin IR Detector on a Small Low-Earth Orbit Satellite
Heffner, H. Craig, Northrop Grumman Corp., USA; Firstbrook, George, Northrop Grumman Corp., USA; Ninth Thermal and Fluids Analysis Workshop Proceedings; November 1999, pp. 81-89; In English; See also 20000025387; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

A practical solution is described for cooling an IR detector to 195K on a small satellite in a low-Earth orbit where size constraints preclude a passive approach using radiation shades. The most important design feature is a Peltier thermo-electric cooler, though the design of all of the components was found to be critical as the temperature requirements approached the limits of what could be achieved using this method. Discussions of the primary design drivers and the results of sensitivity studies of various design parameters are included.
Author
Temperature Control; Infrared Detectors; Low Earth Orbits; Small Satellite Technology

20000025400 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
A Concurrent Design Environment for Designing Space Instruments
Oxnevad, Knut I., Jet Propulsion Lab., California Inst. of Tech., USA; Ninth Thermal and Fluids Analysis Workshop Proceedings; November 1999, pp. 205-216; In English; See also 20000025387; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

At the Project Design Center at the Jet Propulsion Laboratory, a concurrent design environment is under development for supporting development and analyses of space instruments in the early, conceptual design phases. This environment is being utilized by a Team I, a multidisciplinary group of experts. Team I is providing study and proposal support. to provide the required support, the Team I concurrent design environment features effectively interconnected high-end optics, CAD, and thermal design and analysis tools. Innovative approaches for linking tools, and for transferring files between applications have been implemented. These approaches together with effective sharing of geometry between the optics, CAD, and thermal tools are already showing significant timesavings. Further timesavings are expected.
Author
Computer Aided Design; Spacecraft Instruments; Design Analysis; Applications Programs (Computers); Computer Programs; Concurrent Engineering

20000025488 Aerojet-General Corp., Azusa, CA USA
Integrated Advanced Microwave Sounding Unit-A (AMSU-A). Performance Verification Report: Initial Comprehensive Performance Test Report, P/N 1331720-2, S/N 105
Platt, R., Aerojet-General Corp., USA; Feb. 24, 1998; 530p; In English
Contract(s)/Grant(s): NAS5-32314
Report No.(s): NASA/CR-1999-209499; NAS 1.26:209499; Rept-11408; No Copyright; Avail: CASI; A23, Hardcopy; A04, Microfiche

This is the Performance Verification Report, Initial Comprehensive Performance Test Report, P/N 1331720-2, S/N 105, for the Integrated Advanced Microwave Sounding Unit-A (AMSU-A).
Author
Advanced Microwave Sounding Unit; Performance Tests; Meteorological Satellites; Equipment Specifications; Earth Observing System (EOS)

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.

20000025300 NASA Marshall Space Flight Center, Huntsville, AL USA
Paving a Highway to Space
Schafer, C. F., NASA Marshall Space Flight Center, USA; Schmidt, G. R., NASA Marshall Space Flight Center, USA; [1999]; 14p; In English; 49th; Propulsion, 14-17 Dec. 1999, Tucson, AZ, USA; Sponsored by NASA, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents the Paving a Highway to Space at the 49th JANNAF (Joint Army-Navy-NASA-Air force) Propulsion Meeting. The topics include: 1) Earth-to-Orbit; 2) Orbit and Beyond; 3) Duct Propulsion; 4) Electric Propulsion; 5) Beamed Energy Propulsion; 6) Externally-Effected Force; 7) Nuclear Propulsion; 8) The Road to Higher Power Densities and

Performance; 9) Propulsion Technology Map; 10) Launch Applications; 11) Space Applications; and 12) Advanced High-Energy Concepts. This paper is presented in viewgraph form.
CASI
Spacecraft Propulsion; Reusable Launch Vehicles

20000025317 Boeing Co., Rocketdyne Propulsion and Power, Canoga Park, CA USA
Liquid Rocket Propulsion: RS-68 and Linear Aerospike
Murphy, Terry, Boeing Co., USA; Oct. 12, 1999; 64p; In English; 50th; Liquid Rocket Propulsion, 11-12 Oct. 1999, Amsterdam, Netherlands; Sponsored by International Astronautical Federation, USA; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This paper presents viewgraphs of the RS-68 and Linear Aerospike engines. The topics include: 1) The mission; 2) Design and Development Strategies; 3) Cost Driven Design Trades; 4) Moderate Pressure Requirements Enable Reduced Complexity; 5) Experience Based Design; 6) Development Costs Dominated by Cost of Eliminating Failure Modes; and 7) Reducing Development Costs. This paper also includes the design of the RS-68 Engine and the engine performance.
CASI
Aerospike Engines; Liquid Propellant Rocket Engines; Design Analysis

20000025404 NASA Lewis Research Center, Cleveland, OH USA
Numerical Thermal Model of a 30-cm NSTAR Ion Thruster
VanNoord, Jon, Michigan Univ., USA; Gallimore, Alec, Michigan Univ., USA; Rawlin, Vincent K., NASA Lewis Research Center, USA; Ninth Thermal and Fluids Analysis Workshop Proceedings; November 1999, pp. 251-261; In English; See also 20000025387
Contract(s)/Grant(s): NAG3-1572; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

A thermal computer model of the NSTAR (NASA Solar Electric Propulsion Technology Applications Readiness) xenon ion thruster has been produced using a lumped parameter thermal nodal network scheme. This model contains 104 nodes on the thruster and was implemented using SINDA (Systems Improved Numerical Differencing Analyzer) and TRASYS (Thermal Radiation Analyzer System) on various UNIX workstations. The model includes radiation and conduction heat transfer, the effect of plasma interaction on the thruster, and an account for finely perforated surfaces. The model was developed in conjunction with an NSTAR thruster outfitted with approximately 20 thermocouples for thermal testing at the NASA Lewis Research Center. The results of these experiments were used to calibrate and confirm the computer model first without and then with the plasma interaction. The calibrated model was able to predict discharge chamber temperatures to within 10 C of measured temperatures. to demonstrate the ability of the model under various circumstances the heat flux was examined for a thruster operating in the environment of space.
Author
Computerized Simulation; Mathematical Models; Ion Propulsion; Thermal Analysis; Ion Engines; Solar Electric Propulsion

20000025441 GenCorp Aerojet, Sacramento, CA USA
The Role of the Strutjet Engine in New Global and Space Markets
Siebenhaar, A., GenCorp Aerojet, USA; Bonar, D., Boeing Phantom Works, USA; Sarmont, E., Lockheed Martin Corp., USA; [1998]; 1p; In English; 49th, Sep. 1998, Paris, France; Sponsored by International Astronautical Congress
Contract(s)/Grant(s): NAS8-40891; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The Strutjet, discussed in previous IAF papers, was originally introduced as an enabling propulsion concept for single stage to orbit applications. Recent design considerations indicate that this systems also provides benefits supportive of other commercial non-space applications. This paper describes the technical progress of the Strutjet since 1997 together with a rationale why Rocket Based Combined Cycle Engines in general, and the Strutjet in particular, lend themselves uniquely to systems having the ability to expand current space and open new global ”rapid delivery” markets. During this decade, Strutjet technology has been evaluated in over 1000 tests. Its design maturity has been continuously improved and desired features, like simple variable geometry and low drag flowpath resulting in high performance, are verified. In addition, data is now available which allows the designer, who is challenged to maximize system operability and economic feasibility, to choose between hydrogen or hydrocarbon fuels for these application. The ability exists now to apply this propulsion system to various vehicles with a multitude of missions. In this paper, the previously presented earth-to-orbit hydrogen powered vehicle is up3ated and another vehicle, specifically designed for rapid

point-to-point delivery, is introduced and discussed. High payoff propulsion technologies required for these vehicles are identified and laid out in a roadmap spanning over the next decade.
Author
Rocket Engine Design; Rocket-Based Combined-Cycle Engines; Economic Analysis; Cost Effectiveness

20000025489 NASA Glenn Research Center, Cleveland, OH USA
High Power Hall Thrusters
Jankovsky, Robert, NASA Glenn Research Center, USA; Tverdokhlebov, Sergery, Central Research Inst. of Machine Building, Russia; Manzella, David, DYNACS Engineering Co., Inc., USA; Dec. 01, 1999; 18p; In English; 35th; 35th Joint Propulsion Conference, 20-24 Jun. 1999, Los Angeles, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 632-1B-1B
Report No.(s): NASA/TM-1999-209436; NAS 1.15:209436; AIAA Paper 99-2949; E-11912; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The development of Hall thrusters with powers ranging from tens of kilowatts to in excess of one hundred kilowatts is considered based on renewed interest in high power. high thrust electric propulsion applications. An approach to develop such thrusters based on previous experience is discussed. It is shown that the previous experimental data taken with thrusters of 10 kW input power and less can be used. Potential mass savings due to the design of high power Hall thrusters are discussed. Both xenon and alternate thruster propellant are considered, as are technological issues that will challenge the design of high power Hall thrusters. Finally, the implications of such a development effort with regard to ground testing and spacecraft intecrati'on issues are discussed.
Author
Fabrication; Propellants; High Thrust

20000025558 NASA Langley Research Center, Hampton, VA USA
Parametric Model of an Aerospike Rocket Engine
Korte, J. J., NASA Langley Research Center, USA; 2000; 10p; In English; 38th; Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2000, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-1044; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche

A suite of computer codes was assembled to simulate the performance of an aerospike engine and to generate the engine input for the Program to Optimize Simulated Trajectories. First an engine simulator module was developed that predicts the aerospike engine performance for a given mixture ratio, power level, thrust vectoring level, and altitude. This module was then used to rapidly generate the aerospike engine performance tables for axial thrust, normal thrust, pitching moment, and specific thrust. Parametric engine geometry was defined for use with the engine simulator module. The parametric model was also integrated into the iSIGHT multidisciplinary framework so that alternate designs could be determined. The computer codes were used to support in-house conceptual studies of reusable launch vehicle designs.
Author
Aerospike Engines; Reusable Launch Vehicles; Rocket Engine Design; Propulsion System Performance; Trajectory Optimization; Data Bases; Computerized Simulation; Applications Programs (Computers)

20000026857 NASA Marshall Space Flight Center, Huntsville, AL USA
Technology Activities in the Aerodynamics and Hydrodynamics of Propulsion Elements at MSFC (NASA)
Garcia, Roberto, NASA Marshall Space Flight Center, USA; [1999]; 26p; In English; 49th; 49th Propulsion Meeting, 14-17 Dec. 1999, Tucson, AZ, USA; Sponsored by Department of the Army, USA; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This presentation discusses the work towards a second generation reusable launch vehicle (RLV). The goals of the second generation RLV program are reviewed. These include cost, safety, and propulsion advances. The Fluid dynamics technologies under development are discussed. These include the altitude compensating nozzle technology, the Aerospike plume induced base heating, the inducer testing technology. Pictures of altitude compensating nozzles Aerospike Plume Induced Base Heating results and Inducer testing technologies are included. Further goals of the program are to improve the methodology for optimizing design of the injectors, to improve the optimization of the turbopump and improvement of the methodology to analyze the engine performance. This presentation consists of outline view slides
CASI
Aerospike Engines; Hydrodynamics; Propulsion; Reusable Launch Vehicles; Computational Fluid Dynamics; Research and Development

20000027515 NASA Marshall Space Flight Center, Huntsville, AL USA

A Design Tool for Liquid Rocket Engine Injectors

Farmer, Richard C., SECA, Inc., USA; Cheng, Gary, SECA, Inc., USA; Trinh, Huu Phuoc, NASA Marshall Space Flight Center, USA; Tucker, P. Kevin, NASA Marshall Space Flight Center, USA; Hutt, John, NASA Marshall Space Flight Center, USA; [1999]; 2p; In English; Joint Propulsion, 17-19 Jul. 2000, Huntsville, AL, USA; Sponsored by NASA, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

A practical design tool for the analysis of flowfields near the injector face has been developed and used to analyze the Fastrac engine. The objective was to produce a computational design tool which was detailed enough to predict the interactive effects of injector element impingement angles and points and the momenta of the individual orifice flows. to obtain a model which could be used to simulate a significant number of individual orifices, a homogeneous computational fluid dynamics model was developed. to describe liquid and vapor sub- and super-critical flows, the model included thermal and caloric equations of state which were valid over a wide range of pressures and temperatures. A homogeneous model was constructed such that the local state of the flow was determined directly, i.e. the quality of the flow was calculated. Such a model does not identify drops or their distribution, but it does allow the flow along the injector face and into the acoustic cavity to be predicted. It also allows the film coolant flow to be accurately described. The initial evaluation of the injector code was made by simulating cold flow from an unlike injector element and from a like-on-like overlapping fan (LOL) injector element. The predicted mass flux distributions of these injector elements compared well to cold flow test results. These are the same cold flow tests which serve as the data base for the JANNAF performance prediction codes. The flux distributions 1 inch downstream of the injector face are very similar; the differences were somewhat larger at further distances from the faceplate. Since the cold flow testing did not achieve good mass balances when integrations across the entire fan were made, the CFD simulation appears to be reasonable alternative to future cold flow testing. to simulate the Fastrac, an RP-1/LOX combustion model must be chosen. This submodel must be relatively simple to accomplish three-dimensional, multiphase flow simulations. Single RP-1 pyrolysis and partial oxidation steps were chosen and the combustion was completed with the wet CO mechanism. Soot was also formed with a single global reaction. to validate the combustion submodel, global data from gas generator tests and from subscale motor test were used to predict qualitatively correct mean molecular weights, temperature, and soot levels. Because such tests do not provide general kinetics rates, the methodology is not necessarily appropriate for other than rocket type flows conditions. Soot predictions were made so that radiation heating to the motor walls can be made. These initial studies of the Fastrac were for a small region close to the injector face and chamber wall which included a segment of the acoustic cavity. The region analyzed includes 11 individual orifice holes to represent the LOL elements and the H2 film coolant holes. Typical results of this simulation are shown in Figure 1. At this point the only available test data to verify the predictions are temperatures measured in the acoustic cavity. These temperatures are in reasonable agreement at about 2000R (1111 K). Future work is expected to include improving the computational efficiency or the CFD model and/or using more computer capacity than the single Pentium PC with which these simulations were made.

Author

Computational Fluid Dynamics; Flow Distribution; Injectors; Liquid Propellant Rocket Engines; Simulation; Orifices; Flow Measurement; Orifice Flow

20000027528 NASA Marshall Space Flight Center, Huntsville, AL USA

Fabrication and Testing of Ceramic Matrix Composite Rocket Propulsion Components

Effinger, Michael, NASA Marshall Space Flight Center, USA; Clinton, R. G., Jr., NASA Marshall Space Flight Center, USA; Dennis, Jay, NASA Marshall Space Flight Center, USA; Elam, Sandy, NASA Marshall Space Flight Center, USA; Genge, Gary, NASA Marshall Space Flight Center, USA; Eckel, Andy, NASA Glenn Research Center, USA; Jaskowiak, Matha, NASA Glenn Research Center, USA; Kiser, J. Doug, NASA Glenn Research Center, USA; Lang, Jerry, NASA Glenn Research Center, USA; [1999]; 1p; In English; 11th; AeroMat, 26-29 Jun. 2000, Seattle, WA, USA; Sponsored by American Society for Metals, USA Contract(s)/Grant(s): RTOP 713-23-51; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The National Aeronautics and Space Administration (NASA) is pursuing using ceramic matrix composites (CMC) as primary structural components for advanced rocket engines. This endeavor is due to the requirement of increasing safety by two orders of magnitude and reducing costs from $10,000/lb to $1,000/lb both within ten years. Out year goals are even more aggressive. Safety gains, through using CMCS, will be realized by increasing temperature margins, tolerance for extreme thermal transients, and damping capability of components and systems, by using components with lower weight and thermal conductivity, etc. Gains in cost reduction, through using CMCS, are anticipated by enabling higher performance systems, using lighter weight components and systems, enabling 100 mission reusability without system refurbishment, greatly reducing cooling requirements and erosion rates, selecting safe fabrication processes that are ideally cost competitive with metal processes at low volume production, etc. This philosophy contrasts the previous philosophy of rocket engine development focused largely on achieving the highest performance with metals and ablatives -- cost and safety were not the focal point of the initial design. Rocket engine components

currently being pursued, largely C/SiC and SiC/SiC, include blisks or rotors, 10 foot by 8 foot nozzle ramps, gas generators, thrust chambers, and upperstage nozzles. The Simplex Turbopump CMC blisk effort has just successfully completed a 4.5 year development and test program. The other components mentioned are in the design or fabrication stage. Although the temperature limits of the CMC materials are not quantified in a realistic environment yet, CMC materials are projected to be the only way to achieve significant safety risks mitigation and cost reductions simultaneously. We, the end-users, material fabricators, technology facilitators, and government organizations are charged with developing and demonstrating a much safer and a lot less costly Earth-to-Orbit full-scale propulsion system by 2005.
Author
Ceramic Matrix Composites; Rocket Engines; Spacecraft Components; Spacecraft Construction Materials; Rocket Engine Design

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.

20000025772 Case Western Reserve Univ., Dept. of Civil Engineering, Cleveland, OH USA
Development of Optimal Concrete Sealant Techniques ***Final Report***
Mullen, R. L.; Perdikaris, P. C.; Patton, A. B.; May 1999; 94p; In English
Report No.(s): PB2000-102763; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Though concrete coatings and sealants have been known to prolong the service life of concrete highway structures for some time, ignorance of the effect that moisture encapsulation has on the performance of such surface treatments persists. This study investigates the phenomenon of moisture encapsulation and how concrete sealants and coatings influence concrete freeze-/thaw durability and moisture migration.
NTIS
Concretes; Sealers; Evaluation; Concrete Structures; Durability; Encapsulating; Service Life

20000025797 Ohio State Univ., Dept. of Chemistry, Columbus, OH USA
Photochemistry of Fe2(CO)8(Mu-CH2)
Branan, Daniel M.; Jan. 04, 2000; 70p; In English
Report No.(s): AD-A372300; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

We herein present the previously unreported photochemistry of two forms of the dimetallocyclopropane the complex Fe2(CO)8(mu-CH2), and its deuterated analog. We have determined that it behaves similarly to other dimetallic carbonyls in that it eliminates carbon monoxide upon irradiation with high-intensity UV/Visible light to form distinct single and double CO-loss products. Upon formation of a 34-electron single CO-loss product however, it exhibits the ability to either maintain an unbalanced 16/18-electron configuration, or convert to a carbene complex with an iron-iron double bond. This unusual behavior is probably due to the high degree of pi-interaction between the mu-CH2 and the dimetallic center.
DTIC
Photochemical Reactions; Methylene; Deuterium Compounds; Losses

20000027643 Helsinki Univ. of Technology, Lab. of Physics, Espoo, Finland
Diffusive Dynamics of Chainlike Molecules on Surfaces
Hjelt, T.; Oct. 1999; 96p; In English
Report No.(s): PB2000-102678; Copyright; Avail: National Technical Information Service (NTIS)

The dynamics of polymers on solid surfaces is an interesting theoretical problem that has important applications related to thin films. Compared to efforts aimed at studying dynamics of polymers in 3D, the 2D case has been explored much less. The aim of this Thesis is to study the dynamic properties of polymers on surfaces as represented by simplified models of chainlike molecules. In particular, we concentrate on the tracer and collective diffusion coefficients D(T) D(C) respectively. These quantities are defined in the hydrodynamical limit of long times and large length scales, which presents a major computational

challenge due to the lack of self-averaging. to make these calculations possible we have developed two new methods to calculate diffusion coefficients. In the dynamical mean field theory dynamic correlations are neglected.
NTIS
Diffusivity; Molecules; Molecular Chains

24
COMPOSITE MATERIALS

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

20000025308 Tel-Aviv Univ., Ramat-Aviv, Tel-Aviv, Israel
Micromechanical Prediction of the Effective Behavior of Fully Coupled Electro-Magneto-Thermo-Elastic Multiphase Composites
Aboudi, Jacob, Tel-Aviv Univ., Ramat-Aviv, Israel; February 2000; 22p; In English
Contract(s)/Grant(s): NAC3-2252; RTOP 242-23-52
Report No.(s): NASA/CR-2000-209787; E-12072; NAS 1.26:209787; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The micromechanical generalized method of cells model is employed for the prediction of the effective moduli of electro-magneto-thermo-elastic composites. These include the effective elastic, piezoelectric, piezomagnetic, dielectric, magnetic permeability, electromagnetic coupling moduli, as well as the effective thermal expansion coefficients and the associated pyroelectric and pyromagnetic constants. Results are given for fibrous and periodically bilaminated composites.
Author
Micromechanics; Electromagnetic Coupling; Fiber Composites

20000025350 Aerospace Corp., El Segundo, CA USA
Graphite-Epoxy Motor Casing Health Monitoring System Demonstration
Osborn, J. V.; Chan, Y. C.; Klimcak, C. M.; Brown, B.; Williams, B.; Jun. 01, 1999; 21p; In English
Contract(s)/Grant(s): F04701-93-C-0094
Report No.(s): AD-A372112; TR-99(1494)-1; SMC-TR-99-28; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A prototype Multiparameter Sensor System is described for detection, localization, and magnitude determination of impacts as well as environmental condition monitoring of graphite epoxy composite structures. This system is applied to a test sample of a Delta-II solid rocket motor Graphite Epoxy Motor (GEM) casing. Impact detection and localization is performed with a Fiber Optic Bragg strain sensor, while 3-axis acceleration, temperature, pressure and humidity are sampled with Microelectromechanical (MEMS) sensors. All sensors are sampled with a National Instruments, Inc. data acquisition PCMCIA card, processed on a Pentium-II 200-MHz laptop. Sensor information is passed wirelessly to a remote user terminal for display and data storage. Acquisition and display software was written in LabView with custom codes developed for impact localization.
DTIC
Composite Structures; Graphite-Epoxy Composites; Health; Environmental Monitoring; Rocket Engine Cases

20000025399 National Space Development Agency, Office of Research and Development, Tsukuba, Japan
Catalytic Effects of Heat Shield Materials in Dissociated Air
Mizuno, Masahito, National Space Development Agency, Japan; Morino, Yoshiki, National Space Development Agency, Japan; Watanabe, Yasuo, National Aerospace Lab., Japan; Ninth Thermal and Fluids Analysis Workshop Proceedings; November 1999, pp. 181-204; In English; See also 20000025387; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Catalysis of the heat shield materials was preliminarily evaluated by use of arc heated wind tunnel test data and approximate solution on heating rates. Test specimens are C/C materials with Chemical Vapor Deposition(CVD)-SiC coating. Evaluation of the material catalysis was conducted using aerodynamic heating test data obtained by both a 750 kW arc heated wind tunnel of the National Space Development Agency of Japan (NASDA) and a 1 MW arc wind tunnel of the Institut fur Raumfahrtsysteme of the Universitat Stuttgart (IRS). Aerodynamic heating rates on the surface of the specimen were calculated based on the surface temperature distribution. On the other hand, fully catalytic heating rate was calculated by use of the data of heat flux measurements. The ratio of these values are compared with the theoretical values (based on Goulard's theory) and recombination rate constant was estimated to be 5-6 m/s. The difference between NASDA test and IRS test is also discussed in order to verify

the proposed estimation process. Dissociated flow diagnostic in arc wind tunnels would be the most important research issue in the next step.
Author
Heat Shielding; Catalysis; Wind Tunnel Tests; Aerodynamic Heating; Refractory Materials

20000025476 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
The Role of Transverse Flow in Co-Injection Resin Transfer Molding ***Final Report, Jan. 1997 - Jan. 1998***
Fink, Bruce K.; Gillio, Emanuele F.; Advani, Surresh G.; Gillespie, John W., Jr.; Dec. 1999; 39p; In English; Prepared in cooperation with University of Delaware, Newark, DE.
Report No.(s): AD-A372464; ARL-TR-2135; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A co-injection resin transfer molding (CIRTM) process has been developed at the US Army Research Laboratory (ARL) in collaboration with the University of Delaware. It enables two or more resins to be simultaneously injected into a mold filled with a stationary fiber preform. This process allows for the manufacturing of cocured multilayer multiresin structures in a single processing step. A separation layer is used to provide resin compatibility during cure and to control resin mixing. In this study, scaling issues relating the role of transverse permeability in resin mixing are investigated. This report presents two different approaches taken to understand the causes of transverse flow and to quantify the amount of transverse flow. The first approach is a one-dimensional (1-D) model, which explains the important parameters that govern the flow in CIRTM. The second approach is based on an existing finite element code, which is modified to allow for the injection of multiple resins. The total amount of transverse flow was quantified using the finite element code. This research shows that he CIRTM process requires a totally impermeable separation layer if CIRTM is used to manufacture large parts and/or if the resins injected have significantly different viscosities.
DTIC
Injection Molding; Phenolic Resins

20000027534 University of Southern California, Dept. of Materials Science and Mechanical Engineering, Los Angeles, CA USA
Creep Behavior of a Reinforced Al-7005 Alloy: Implications for the Creep Processes in Metal Matrix Composites
Li, Yong, University of Southern California, USA; Langdon, T. G., University of Southern California, USA; Pergamon; 1998; ISSN 1359-6454; Volume 46, No. 4, pp. 1143-1155; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Creep tests were conducted on an Al-7005 matrix alloy reinforced with 20 vol.% of irregularly shaped Al2O3 particulates. The results, which cover almost six orders of magnitude of strain rate, give high values for the apparent stress exponent and the apparent activation energy for creep. The introduction or a threshold stress into the analysis leads to a stress exponent of approx. 4.4 and data which are consistent with creep controlled by a dislocation climb process and class M behavior in the Al-7005 matrix alloy. These results art compared with an earlier report of creep behavior in an Al-6061 matrix composite also reinforced with 20 vol.% of irregularly shaped Al2O3 particulates, where the stress exponent was close to three and the data were consistent with control by a dislocation glide process and class A behavior in the Al-6061 matrix alloy. It is shown that the creep of metal matrix composites is controlled by creep of the matrix alloys and there is a consequent division of the creep behavior of the composites into two types, class M and class A, as in the creep of solid solution alloys.
Author
Creep Properties; Aluminum Alloys; Metal Matrix Composites; Creep Tests

20000027617 Notre Dame Univ., Dept. of Aerospace and Mechanical Engineering, IN USA
Application of Dynamic Fracture Mechanics Concepts to Composites: Final Report 2000 ***Final Report, 1 Jun. 1996, 31 Dec. 1999***
Mason, J. J.; Jan. 31, 2000; 83p; In English
Contract(s)/Grant(s): N00014-96-1-0774
Report No.(s): AD-A373293; UNDAS-00/1; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report summarizes the work completed in the months of June 1996 - December 1999 for the principal investigator's Young Investigator Program grant. As such, the report represents a final summary of work, organized as follows. First, in a brief summary chapter, a review of the accomplishments of the work supported from June 1996 to December 1999 is given providing an overview of the successes during that period. Next, two chapters giving details of new work during the six months since the last annual report are presented. In these results, an experimentally useful solution for the stress intensity factor history at the comer of an impacting punch is derived for isotropic and orthotropic materials. Then that solution is compared to experimental

measurements of the stress intensity factor history at the comer of an impacting punch in both isotropic and anisotropic materials. Good agreement between model and experiments is seen.
DTIC
Composite Materials; Fracture Mechanics

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.

20000025480 Stanford Univ., Edward L. Ginzton Lab. of Physics, Stanford, CA USA
Study of Photorefractive Effects in Periodically-Poled Lithium Niobate ***Final Report, 15 Mar. 1997 - 14 Mar. 1998***
Alexandrovski, A.; Route, R. K.; Fejer, M. M.; Nov. 1999; 16p; In English
Report No.(s): AD-A372478; SPO-17602; AFRL-SR-BL-TR-00-0013; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of this DURIP-97 program was to facilitate investigation of photo-refractive effects in periodically poled lithium niobate (PPLN). Performance limitations due to photo-refractivity were studied using photo-thermal common-path interferometry (PCI) to determine if photo-refractive damage sensitivity is dependent on grating duty cycle. The PCI technique operates in a ”pump-probe” configuration, and is sensitive to both linear optical absorption at the ppm/cm level and photo-refraction. Bulk and waveguide frequency doubling PPLN modules having a range of grating pitches were fabricated by Corporation. In the bulk PPLN devices, optimum performance was found in modules with a nominal duty cycle close to the 50% value predicted by assuming that photo-refraction in lithium niobate is caused by photo-galvanic charge separation and that the alternating ferroelectric domain polarity due to the grating acts to ”short-circuit” any charge build-up. Similar optimum performance is expected from waveguide harmonic conversion devices which have 40-50% duty cycles.
DTIC
Photorefractivity; Lithium Niobates

20000025482 Michigan Technological Univ., Dept. of Physics, Houghton, MI USA
Atomistic and Ab Initio Calculations or Ternary II-IV-V2 Semiconductors ***Final Report, 1 Aug. 1996 - 31 Jul. 1999***
Pandey, Ravi; Dec. 07, 1999; 61p; In English
Contract(s)/Grant(s): F49620-96-1-0319; AF Proj. 2305
Report No.(s): AD-A372481; AFRL-SR-BL-TR-00-0009; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Atomistic and ab initio methods are used to study structural and electronic properties of perfect and defective chalcopyrites, specifically, ZnGeP2 and CdGeAs2. These materials are important due to their suitability for nonlinear optical applications in the infrared region and have a wide transparency region. A new set of interatomic potential parameters consisting of two- and three-body terms is developed reproducing crystal lattice constants, elastic and dielectric constants very well. The calculated formation energies for native defects suggest that the intrinsic disorder is dominated by antisites in the cation sublattice followed by the Schottky and Frenkel defects. Although both compounds belong to the same chalcopyrite family, the nature of dominant acceptors is predicted to be different. Defect calculations corroborating the experimental studies find that the zinc vacancy, not the zinc antisite (ZnGe), is associated with the dominant acceptor center in ZnGeP2. This is not the case in CdGeAs2 where a cadmium antisite (CdGe) is predicted to be associated with the dominant acceptor in the lattice. This difference may well be due to defect-induced lattice distortion which plays a key role in stabilizing the hole states in the lattice.
DTIC
Semiconductors (Materials); Ternary Alloys; Quantum Chemistry

20000025531 Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC USA
Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities: Peer Review Draft, Volume 1
Nov. 1999; 372p; In English
Report No.(s): PB2000-101330; EPA/530/D-99/001A; No Copyright; Avail: National Technical Information Service (NTIS)

The report provides guidance to US EPA regions and state government on how to best implement Resource Conservation and Recovery Act (RCRA) and other US EPA regulations to facilitate permitting decisions for hazardous waste combustion

facilities. It addresses facility characterization, including compiling basic facility data, identifying emission sources and compounds of concern (COPC), estimating COPC concentrations for non-detects, and concentrations detected in blanks. It discusses air dispersion and deposition modeling, problem formulation, analysis (exposure assessment and assessment of toxicity), and risk characterization. It includes references, tables and figures.
NTIS
Risk; Protocol (Computers); Resources Management; Hazardous Wastes; Assessments; Ecosystems; Pollution Control

20000027521 Iowa Univ., Lab. for Photonics and Quantum Electronics, Iowa City, IA USA
Measurement of the Ultrafast Polarization Dynamics of Weak Four-Wave Mixing Signals by Dual-Channel Femtosecond Spectral Interferometry
Buccafusca, O., Iowa Univ., USA; Chen, X., Iowa Univ., USA; Walecki, Wojciech J., Iowa Univ., USA; Smirl, Arthur L., Iowa Univ., USA; Journal of Optical Society of America B; March 1998; ISSN 0740-3224; Volume 15, No. 3, pp. 1218-1224; In English
Contract(s)/Grant(s): DAAG55-98-I-0436
Report No.(s): AD-A369895; ARO-38888.5-EL; Copyright; Avail: Issuing Activity, Microfiche, Hardcopy

We demonstrate that a dual-beam version of spectral interferometry together with a well-characterized reference pulse can be used to measure accurately the temporal dynamics of the polarization state of weak ultrafast four-wave mixing emission from semiconductor multiple quantum wells. We completely determine the electric field, including its vectorial nature, by measuring the amplitude and the phase dynamics of two orthogonal components of the field. This technique directly measures quantities in the spectral domain, and the temporal information is obtained only after considerable processing. Nevertheless, we establish the accuracy of the technique by comparing the spectral interferometric results with the corresponding data obtained by direct time-resolved ellipsometry. The data reveal that the four-wave mixing polarization date changes its ellipticity and its orientation dramatically during a single emission. The latter attribute indicates the usefulness of this technique for studying manybody effects, because without them a constant linear polarization state would be expected.
Author
Four-Wave Mixing; Signal Mixing; Spectra; Interferometry

20000027538 Stanford Univ., Stanford, CA USA
Ignition Delay Times of Ram Accelerator CH4/O2/Diluent Mixtures
Petersen, Eric L., Stanford Univ., USA; Davidson, David F., Stanford Univ., USA; Hanson, Ronald K., Stanford Univ., USA; Journal of Propulsion and Power; January 1999; Volume 15, No. 1, pp. 82; In English; 32nd, 1-3 Jul. 1996, Lake Buena Vista, FL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 96-2681; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

An experimental study was performed to determine Ignition delay times for CH4/O2/diluent mixtures and conditions relevant to forebody combustion on ram accelerator projectiles All measurements were performed In the reflected-shock region of a high-pressure shock tube. Temperatures from 1040 to 1600 K and pressures between 33 and 260 atm were studied, and the CH4/O2/diluent mixtures bad an equivalence ratio of 0.4, 3.0, or 6.0 with either N2, Ar; or He as the bath gas. Reaction progress was monitored primarily via piezoelectric pressure transducer mid visible emission. For each mixture and condition, the ignition developed as a strong, ignition front beginning at the endwall with little or no preignition deflagration. Ignition delay time (tau(sub ign)) correlations were generated for each mixture and the entire data set; the latter correlation indicates that ignition delay is dependent only on the fuel and oxidizer concentrations and, therefore, not on the diluent species or concentration. At temperatures below approximately 1300 K for the fuel-rich mixtures, the Arrhenius temperature dependence of tau(sub ign) changes from an average activation energy of 32.7 kcal/mol, at higher temperatures, to approximately 19.0 kcal/mol. at lower temperatures. The transition occurs at higher temperatures as the pressure is increased, and is indicative of a shift in chain-branching kinetics between the high- and intermediate-temperature regimes.
Author
Ignition; Electron Accelerators; Dioxides; Methane; Experimentation; Combustion; Kinetics; Oxidizers; Time Lag

20000027626 Naval Postgraduate School, Monterey, CA USA
Operational and Calibration of the NPS Ultraviolet Imaging Spectrometer (NUVIS) in the Detection of Sulfur Dioxide Plumes
Marino, Stephen A.; Dec. 1999; 104p; In English
Report No.(s): AD-A373307; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The Naval Postgraduate School's Ultraviolet Imaging Spectrometer (NUVIS) is a hyperspectral sensor with a spectral response of 300 to 375 nanometers. This thesis research concentrates on the operation and calibration of NUVIS in the detection

of effluent sulfur dioxide (SO2) plumes. NUVIS is capable of detecting and quantifying SO2 emissions in the form of effluent smokestack plumes by exploiting SO2's unique UV absorption signature. Laboratory comparison UV spectra of 502 were recorded and used to calculate curves of growth for four different 502 spectral features. Laboratory results were employed to analyze field data taken of a coal-burning power plant. Analysis of this plume data yielded a mean plume SO2 mixing ratio of 365 i 200 ppm, in agreement with the in situ stack value of 400 ppm. Further assessment of NUVIS indicates that its lower limit for SO2 detection in typical field applications is approximately 70 ppm.
DTIC
Calibrating; Sulfur Dioxides; Ultraviolet Spectrometers

26
METALS AND METALLIC MATERIALS

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

20000025341 Massachusetts Inst. of Tech., Dept. of Materials Science and Engineering, Cambridge, MA USA
Fretting Fatigue Analysis and Palliatives
Kirkpatrick, Gary W.; Jun. 1999; 100p; In English
Report No.(s): AD-A372220; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

The deleterious effects of fretting on the fatigue properties of a material have been known since the work of Warlow-Davies in 1941. However, a widely accepted fretting fatigue life prediction method still does not exist and debates persist as to what the critical parameter(s) for fretting fatigue are. This work demonstrates that the surface stresses due to contact can be used to characterize the damaging effects of fretting on the fatigue properties of a material. The elastic stress analysis performed by Hamilton for a sphere on flat plane fretting geometry is used to determine the stresses due to contact for various experimental conditions provided in previous work. It is shown that the specimen fretting fatigue life is directly related to the surface stresses induced in the material by fretting. Fretting fatigue life prediction methods are analyzed. The stress-life approach, which is widely used in industry, is examined for its applicability for fretting fatigue conditions. The damage tolerant approach is used to determine the relative magnitudes of the crack nucleation and long crack propagation stages of fretting fatigue life. An analysis of fretting fatigue palliatives, focusing on shot peening and coatings, is presented. A systematic method to determine the optimum shot peening depth for fretted components is proposed. The method uses the elastic stress field expressions derived by Hamilton for a sphere on flat surface contact geometry and is demonstrated for Ti-6Al-4V. However, the method is general and can be applied for any material and any contact geometry which allows analytic evaluation of the stress fields.
DTIC
Fatigue (Materials); Fretting; Fatigue Life; Prediction Analysis Techniques; Durability

20000027495 Fukuoka Univ. of Education, Dept. of Technology, Munakata, Japan
Microstructural Characteristics and Superplastic Ductility in a Zn-22% Al Alloy with Submicrometer Grain Size
Furukawa, Minoru, Fukuoka Univ. of Education, Japan; Ma, Yan, University of Southern California, USA; Horita, Zenji, Kyushu Univ., Japan; Nemoto, Minoru, Kyushu Univ., Japan; Valiev, Ruslan Z., Ufa State Technical Aviation Univ., Russia; Materials Science and Engineering A; 1998; ISSN 0921-5093; Volume 241, pp. 122-128; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Submicrometer grain sizes were introduced into a Zn-22% Al eutectoid alloy using two different procedures: torsion straining and equal-channel angular (ECA) pressing. Microstructural examination showed that torsion straining gives an essentially equiaxed grain configuration with some mixing of the two separate phases. After ECA pressing to a strain of approx. 8 at a temperature of 373 K, them is a submicrometer grain size but with agglomerates of ultrafin.- Al-rich and Zn-rich grains which are formed by the separate division of the original grains into smaller submicrometer grains with only very limited mixing of the two phases. Tensile testing of the ECA pressed material gave neck-free superplastic flow but, except only at 473 K at the fastest strain rate of approx. 0.1 / s where the elongation was unusually high, the elongations to failure were similar to those reported earlier for a commercial alloy with a grain size of approx. 2.5 microns. The results demonstrate the need to develop an ECA pressing procedure which avoids the formation of agglomerates of the two phases.
Author
Microstructure; Aluminum Alloys; Zinc Alloys; Eutectics; Grain Size; Plastic Properties

20000027641 Helsinki Univ. of Technology, Lab. of Materials Processing and Powder Metallurgy, Espoo, Finland
Nickel Smelting Slags
Jyrkoenen, S.; Sjoeblom, J.; 1999; ISSN 1455-2329; 34p; In English
Report No.(s): PB2000-102667; TKK-MK-69; ISBN 951-22-4576-0; Copyright; Avail: National Technical Information Service (NTIS)

Contents include the following: Introduction; Backgrounds of Nickel Smelting; Nickel Flash Smelting; Slags in Nickel Smelting Process; Physical Properties of Slags; Metal Dissolution in Slag; Slag Cleaning; Summary; References.
NTIS
Nickel; Smelting; Slags

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.

20000025311 Naval Facilities Engineering Service Center, Port Hueneme, CA USA
Concrete Floor Condition Assessment ***Final Report, May-Oct 1999***
Gaughen, C. D.; Nov. 1999; 12p; In English
Report No.(s): AD-A372488; NFESC-UG-2038-SHR; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Users Guide presents a systematic approach to assessing the condition of concrete floors prior to specifying one of three coating systems: (A) Thin film coating system (> or = 13 mils: 1 mil = 0.001”), (B) Thick film coating system (>/= 250 mils), and (C) Overcoating sound coating systems. by assessing the condition of floor surfaces, coating failures resulting from the following practices should decrease: (1) Overcoating unsound coating systems, (2) Coating concrete with low surface strength, (3) Coating concrete with high levels of surface contamination (oils, fuels, skydrol, fats, waxes, etc.), and (4) Coating concrete with a high rate of moisture vapor emission.
DTIC
Concretes; Coatings; Manuals; Floors

20000025447 Naval Facilities Engineering Service Center, Port Hueneme, CA USA
Condition Assessment and Coating Recommendations for Aircraft Maintenance Hangars ***Final Report, May - Sep. 1999***
Gaughen, C. D.; Oct. 1999; 16p; In English
Report No.(s): AD-A372490; NFESC-UG-2036-SHR; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Users Guide presents a systematic approach to assessing the condition of aircraft maintenance hangar floors prior to specifying one of three coating systems: (1) Thin film coating system (16 mils: 1 mil = 0.001”), (2) Thick film coating system (250 mils), and (3) Overcoating sound coating systems. Coating specifications based upon the above coating systems are presented in the Naval Facilities Engineering Service Center’s (NFESC) Special Publication titled Hangar Floor Coating Specifications: Thin Film, Thick Film, and Overcoating Sound Coating Systems (SP-2057-SHR). by assessing the condition of hangar floor surfaces, coating failures resulting from the following practices should decrease: (1) Overcoating unsound coating systems, (2) Coating concrete with low surface strength, (3) Coating concrete with high levels of hydrocarbon contamination (oils, fuels, skydrol), and (4) Coating concrete with a high rate of moisture vapor emission.
DTIC
Aircraft Maintenance; Hangars; Protective Coatings

20000025496 Moscow State Univ., Dept. of Chemistry, Russia
Liquid Crystalline Dendrimers ***Final Report, Nov. 1997 - Nov. 1998***
Shibaev, V. P.; Boiko, N. I.; Muzafarov, A. M.; Rebrov, E. A.; Ponomarenko, S. A.; Aug. 1999; 47p; In English
Contract(s)/Grant(s): N68171-97-M-5822
Report No.(s): AD-A372433; MSU-ERO-C-FR/99; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The influence of molecular construction of LC dendrimers on their phase behavior and properties have been studied. First to five generations of carbosilane LC dendrimers with 8, 16, 32, 64 and 128 terminal mesogenic groups (cyanobiphenyl, methoxyphenyl benzoate, ethyl lactate derivatives, etc.) have been synthesized. Investigation of thermal behavior and structure of LC dendrimers reveals smectic mesophases over a wide temperature region. LC dendrimers with terminal ethyl-L-lactate-containing mesogenic groups exhibit a chiral smectic C mesophase possessing ferroelectricity. It was found for

the first time that LC dendrimers of fifth generation have two levels of structural organization: smectic-like arrangement of mesogenic groups and supramolecular assembling of LC dendrimers in nanostructures of columnar type. Hydrodynamic and electrooptical properties of solutions of LC dendrimers synthesized have been studied. The results demonstrate, that hydrodynamic behavior of LC dendrimers is similar to the behavior of solid unpermeable particles, which radius of gyration is proportional to the molar mass to the power of 1/3. At the same time, the chain character of these dendrimers is exhibited in temperature dependence of viscosity and small-scale mechanism of their orientation in the electric field, that reflects their polymeric nature.
DTIC
Crystallinity; Liquid Crystals; Dendritic Crystals; Molecular Structure; Nanostructures (Devices); Crystal Structure

20000025504 NASA Langley Research Center, Hampton, VA USA
Method of Making Thermally Stable, Piezoelectric and Proelectric Polymeric Substrates
Simpson, Joycelyn O., Inventor, NASA Langley Research Center, USA; St.Clair, Terry L., Inventor, NASA Langley Research Center, USA; Jun. 08, 1999; In English; Division of US-Patent-Appl-SN-524855, filed 7 Sep. 1995
Patent Info.: Filed 30 Aug. 1996; NASA-Case-LAR-15279-1; US-Patent-5,909,905; US-Patent-Appl-SN-706122; US-Patent-Appl-SN-524855; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

A thermally stable, piezoelectric and pyroelectric polymeric substrate was prepared. This thermally stable, piezoelectric and pyroelectric polymeric substrate may be used to prepare electromechanical transducers, thermomechanical transducers, accelerometers, acoustic sensors, infrared sensors, pressure sensors, vibration sensors, impact sensors. in-situ temperature sensors, in-situ stress/strain sensors, micro actuators, switches, adjustable fresnel lenses, speakers, tactile sensors, weather sensors, micro positioners, ultrasonic devices, power generators, tunable reflectors, microphones, and hydrophones. The process for preparing these polymeric substrates includes: providing a polymeric substrate having a softening temperature greater than 100 C; depositing a metal electrode material onto the polymer film; attaching a plurality of electrical leads to the metal electrode coated polymeric substrate; heating the metal electrode coated polymeric substrate in a low dielectric medium: applying a voltage to the heated metal electrode coated polymeric substrate to induce polarization; and cooling the polarized metal electrode coated polymeric electrode while maintaining a constant voltage.
Official Gazette of the U.S. Patent and Trademark Office
Coatings; Piezoelectricity; Pyroelectricity; Substrates; Polymeric Films; Conducting Polymers

20000027518 Pittsburgh Univ., Dept. of Chemical and Petroleum Engineering, Pittsburgh, PA USA
Attraction Between Surfaces in a Polymer Melt Containing Telechelic Chains: Guidelines for Controlling the Surface Separation in Intercalated Polymer--Clay Composites
Zhulina, Ekaterina, Pittsburgh Univ., USA; Singh, Chandralekha, Pittsburgh Univ., USA; Balazs, Anna C., Pittsburgh Univ., USA; Langmuir; 1999; Volume 15, pp. 3935-2943; In English
Contract(s)/Grant(s): DAAG55-98-I-0115
Report No.(s): AD-A369933; ARO-37574.3-CH; Copyright; Avail: Issuing Activity, Microfiche, Hardcopy

Using numerical and analytical self-consistent field (SCF) calculations, we investigate the interactions between two closely spaced surfaces and the surrounding polymer melt. which contains a volume fraction of end-functionalized polymers. The functionalized polymers contain two reactive 'stickers', one at each end of the chain. that are highly attracted to the surfaces. The surfaces model clay crystallites, or sheets. Through the calculations, we determine the free energy profiles as the surfaces are pried apart and the polymer fills the gap. The free energy vs distance plots reveal a distinctive minimum, even at very small volume fractions of the end functionalized chains. Thus, the presence of these telechelic: polymers promotes the formation of thermodynamically stable intercalated composites. where the polymers enhance the separation between the silicate sheets. However, the telechelic chains prohibit the creation of the more desirable exfoliated structures where the sheets are uniformly dispersed throughout the polymer matrix. The results provide guidelines for significantly enhancing the separation between the sheets. Thus possibly making properties of the intercalated composites more like the exfoliated material.
Author
Clays; Polymers; Polymer Physics; Polymer Matrix Composites; Free Energy

20000027531 California Univ., Depts. of Materials and Chemistry, Santa Barbara, CA USA
Cobalt and Iron Initiators for the Controlled Polymerization of Alpha-Amino Acid-N-Carboxyanhydrides
Deming, Timothy J., California Univ., USA; Macromolecules; 1999; Volume 32, pp. 4500-4502; In English
Contract(s)/Grant(s): DAAH04-96-I0443
Report No.(s): AD-A369885; ARO-36272.64.MS-MR; Copyright; Avail: Issuing Activity, Microfiche, Hardcopy

Polypeptides are interesting polymers because their structural complexity imparts these materials with specific biological functions. Although methods for preparation of high-molecular-weight polypeptides have existed for over 100 years, this chemistry, the polymerization of a-amino acid-N-carboxyanhydrides (NCAs), has been plagued by side reactions. Chain transfer and termination reactions have limited this methodology to the preparation of polypeptides that lack the complexity of natural proteins. Recently, we discovered that the zerovalent nickel complex, bpyNi(COD), initiates the polymerization of NCAs and supports polymerization while greatly eliminating side reactions. After identifying the mechanism by which this initiator operates, we sought to develop initiators based on other transition metals to see if they might provide advantages for polymerization. identifying the mechanism by which this initiator operates, we sought to develop initiators based on other transition metals to see if they might provide advantages for polymerization. It was found that the reaction chemistry of NCAs with zerovalent metals is general for the metals iron, cobalt, and nickel, which all form products resulting from Oxidative addition of the monomer to the metal across the O--C5 anhydride bond. Due to the high reactivity of zerovalent cobalt, the complex (PMe3)4Co was found to initiate NCA polymerizations more rapidly than did bpyNiCOD), allowing the preparation of well-defined short sequences of amino acids in block copolypeptides.
Derived from text
Iron; Polymerization; Polypeptides; Chemical Reactions; Cobalt

20000027535 Arkansas Univ., Dept. of Physics, Fayetteville, AR USA
Tl2Ba2CaCu2O(y) Superconducting Thin Films on Polycrystalline Al2O3 Substrates With Textured YSZ Buffer Layers
Xiong, Q., Arkansas Univ., USA; Afonso, S., Arkansas Univ., USA; Chen, K. Y., Arkansas Univ., USA; Salamo, G., Arkansas Univ., USA; Chan, F. T., Arkansas Univ., USA; Physica C; 1997; ISSN 0921-4534; Volume 280, pp. 17-20; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

We report for the first time the successful fabrication Of Tl2Ba2CaCu2O(y) superconducting thin films on polycrystalline A12O3 substrates using yttria-stabilized-zirconia (YSZ) buffer layers. Ion beam-assisted laser deposition was used to obtain the textured YSZ buffer layers. The Tl2Ba2CaCu2O(y) thin films were shiny, highly c-axis oriented with respect to the film surface and strongly in plane textured. The zero resistance temperature of these films was as high as 108 K with a critical current density of approx. 105 A/sq cm at 77 K.
Author
Superconductivity; Thin Films; Polycrystals; Aluminum Oxides; Substrates; Yttria-Stabilized Zirconia; Fabrication

20000027628 Department of Defense, Washington, DC USA
Mixing and Transporting Concrete
Vinci, Greg; May 24, 1999; 23p; In English
Report No.(s): AD-A373352; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The successful placement of concrete is dependent upon careful mixing, the proper equipment, and adequate transportation. This paper will define, analyze and demonstrate the importance of each in the overall process of placing concrete.
DTIC
Concretes; Transportation

20000027631 New Jersey Inst. of Tech., Dept. of Civil and Environmental Engineering, Newark, NJ USA
Recycled Plastics for Highway Appurtenances ***Final Report, May 1995 - Apr. 1998***
Saadeghvaziri, M. A.; MacBain, K. M.; Jul. 1999; 158p; In English
Report No.(s): PB2000-102817; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The overall objective of this research and development study is to develop highway applications for recycled plastics that will have performance characteristics that are similar to, of not superior than, traditional designs. The primary applications are the use of recycled plastics for noise walls and guardrail posts. However, due to lack of knowledge about the material, especially the long term performance, a significant portion of the effort was devoted toward material testing and evaluation of mechanical and structural properties. Acoustical and wind tests of the noise walls and analytical crash tests of the guardrail posts are among other objectives of the study.
NTIS
Recycling; Plastics; Structural Analysis

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.

20000025497 NASA Marshall Space Flight Center, Huntsville, AL USA
Magnetically Actuated Propellant Orientation, Controlling Fluids in a Low-Gravity Environment
Martin, James J., NASA Marshall Space Flight Center, USA; Holt, James B., NASA Marshall Space Flight Center, USA; Jan. 01, 2000; 9p; In English; 36th; Joint Propulsion, 16-19 Jul. 2000, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Cryogenic fluid management (CFM) is a technology area common to virtually every space transportation propulsion concept envisioned. Storage, supply, transfer and handling of sub-critical cryogenic fluids are basic capabilities that have long been needed by multiple programs and the need is expected to continue in the future. The use of magnetic fields provides another method, which could replace or augment current/traditional approaches, potentially simplifying vehicle operational constraints. The magnetically actuated propellant orientation (MAPO) program effort focused on the use of magnetic fields to control fluid motion as it relates to positioning (i.e. orientation and acquisition) of a paramagnetic substance such as LO2. Current CFM state- of-the-art systems used to control and acquire propellant in low gravity environments rely on liquid surface tension devices which employ vanes, fine screen mesh channels and baskets. These devices trap and direct propellant to areas where it's needed and have been used routinely with storable (non-cryogenic) propellants. However, almost no data exists r,egarding their operation in cryogenics and the use of such devices confronts designers with a multitude of significant technology issues. Typical problems include a sensitivity to screen dry out (due to thermal loads and pressurant gas) and momentary adverse accelerations (generated from either internal or external sources). Any of these problems can potentially cause the acquisition systems to ingest or develop vapor and fail. The use of lightweight high field strength magnets may offer a valuable means of augmenting traditional systems potentially mitigating or at least easing operational requirements. Two potential uses of magnetic fields include: 1) strategically positioning magnets to keep vent ports clear of liquid (enabling low G vented fill operations), and 2) placing magnets in the center or around the walls of the tank to create an insulating vapor pocket (between the liquid and the tank wall) which could effectively lower heat transfer to the liquid (enabling increased storage time).
Author
Magnetic Fields; Activation Energy; Microgravity; Storable Propellants; Propulsion; High Field Magnets; Field Strength

20000025546 Battelle Ocean Sciences, Duxbury, MA USA
Predicting the Behavior of Orimulsion Spilled on Water, Volume 1 ***Final Report***
Stout, Scott A.; Jul. 1999; 128p; In English
Contract(s)/Grant(s): DTRS-57-95-G-00063
Report No.(s): AD-A371851; CG-D-24-99; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Orimulsion is a fuel that is a bitumen-in-water emulsion made of approximately approx. 70% natural bitumen and approx. 30% fresh water. Orimulsion is of great interest to electric power utilities because of its competitive cost and pricing structure. Previous work on Orimulsion has determined it may largely float, remain suspended, or settle depending on the spill conditions. In this study, the mechanisms at work and the relative importance of different spill conditions (e.g., salinity, temperature, energy, Orimulsion concentration, particulate load, and particulate type) are investigated by: (1) forty-seven benchtop scale (3L) experiments conducted and evaluated using design of experiment principles, and (2) five flume scale (4000L) experiments. The insight gained from these laboratory experiments is interpreted in light of the limitations inherent in laboratory spills into confined vessels (e.g., vessel wall effects and absence of dilution) in order to predict the gross behavior that might be anticipated if Orimulsion were spilled in a
DTIC
Fresh Water; Spilling; Fuels; Water Pollution

20000025796 Tennessee Valley Authority, Muscle Shoals, AL USA
Demonstration Results of Phytoremediation of Explosives-Contaminated Groundwater Using Constructed Wetlands At The Milan Army Ammunition Plant, Milan, Tennessee Volume IV ***Final Report***
Sikora, F. J.; ALmond, R. A.; Behrends, L. L.; Hoagland, J. J.; Kelly, D. A.; Dec. 1998; 394p; In English
Report No.(s): AD-A372289; No Copyright; Avail: CASI; A17, Hardcopy; A04, Microfiche

This report describes a demonstration of phytoremediation methods to remediate explosives-contaminated groundwater. The demonstration was conducted at the Milan Army Ammunition Plant near Milan, Tennessee, using a gravel-based subsurface flow wetland and a lagoon-based surface flow wetland. The report provides demonstration results as they are related to the effectiveness of the wetlands; and provides cost and other information necessary for the transfer of the technology to the user community. The report concludes that gravel-based wetlands could be used to remediate groundwater contaminated with a variety of explosives including TNT and RDX and that, based on the demonstration results, the use of lagoon-based wetlands could not be recommended.
DTIC
Explosives; Ground Water; Water Pollution; Contamination; Technology Transfer

20000026931 Federal Aviation Administration, Airport and Aircraft Safety Research and Development Div., Atlantic City, NJ USA
Mass Loading Effects on Fuel Vapor Concentrations in an Aircraft Fuel Tank Ullage
Summer, S. M.; Sep. 1999; 20p; In English
Report No.(s): PB2000-102404; DOT/FAA/AR-TN99/65; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This report discusses experiments performed within a simulated fuel tank approximately 1/20 the size of a typical B-747 center wing fuel tank (CWT). The vapors generated within the ullage of this tank were analyzed under different mass loadings in an effort to determine the effects of the mass loading and fuel distribution. It was determined from these tests that in order to have a substantial effect on the flammability of the vapor within the CWT, the mass loading would have to be somewhere between 0.08 and 0.15 kg/cu m. A substantial effect was defined as a minimum 20% decrease in the maximum hydrocarbon count when compared to the average of all tests conducted with larger mass loadings. In addition, it was found that while the distribution of the fuel has no effect on the peak flammability (vapor composition) that is reached, it does have a significant effect on how long it takes to reach the final state. The less dispersed the liquid fuel is, the longer it will take the vapor to reach its maximum flammability point.
NTIS
Mass Distribution; Fuel Flow; Fuel Consumption; Ullage; Fuel Tanks; Liquid Sloshing; Concentration (Composition)

20000027494 Energy Information Administration, Office of Coal, Nuclear, Electric and Alternate Fuels, Washington, DC USA
Renewable Energy 1998: Issues and Trends
Mar. 1999; 102p; In English
Report No.(s): PB2000-102802; DOE/EIA-0628(98); No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
Renewable Electricity Purchases: History and Recent Developments presents an analysis of prices of renewable-based electricity that utilities have paid to nonutilities, the primary generators of renewable electricity. The average price utilities paid for electricity generated by nonutilities using renewable energy was 8.8 cents per kilowatthour in 1995, the most recent year for which complete data were available. This compares with 5.5 cents per kilowatthour for electricity purchased from nonrenewable nonutility generators. The higher prices for renewable-based electricity reflect, in part, the effects of the Public Utility Regulatory Policies Act (PURPA) which required utilities to purchase power from qualified facilities at full avoided costs. Since natural gas prices did not rise as much as expected, estimates of future avoided costs were higher than ever materialized. Therefore, as older contracts expire, new contracts reflect lower avoided costs.
NTIS
Energy Sources; Cost Reduction; Electricity; Estimates; Utilities

20000027642 Helsinki Univ. of Technology, Lab. of Industrial Chemistry, Espoo, Finland
Preparation and Characterization of Supported CrO(x) Catalysts for Butane Dehydrogenation
Hakuli, A.; Nov. 26, 1999; 106p; In English
Report No.(s): PB2000-102677; Copyright; Avail: National Technical Information Service (NTIS)
Butenes, important in the production of components for reformulated gasoline, city diesel, and for chemical industry can be produced by dehydrogenation from the corresponding alkanes. The aim of this work was to examine the surface characteristics of CrO(x)/alumina catalysts and their behavior in butane dehydrogenation. The effects of Cr loading, reducing agent, preparation technique, and the support on the surface characteristics were studied by XPS, wet-chemical method (Cr(6+)), LEIS, DRIFTS, XRD, and H2-TPR, and the effects on the initial dehydrogenation activity by on-line, multicomponent FT-IR gas analysis. FT-IR allows rapid monitoring of product mixtures, and thus the initial activity of the catalysts could be accessed.
NTIS
Gas Analysis; Catalysts; Butanes; Dehydrogenation; Chromium Oxides

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.

20000025374 NASA Lewis Research Center, Cleveland, OH USA

Microgravity Experiments to Evaluate Electrostatic Forces in Controlling Cohesion and Adhesion of Granular Materials

Marshall, J., Search for Extraterrestrial Intelligence Inst., USA; Weislogel, M., NASA Lewis Research Center, USA; Jacobson, T., NASA Lewis Research Center, USA; Studies of Mineralogical and Textural Properties of Martian Soil: An Exobiological Perspective; September 1999, pp. 49-51; In English; 4th; Microgravity Fluid Physics and Transport Phenomena, 1998, Cleveland, OH, USA; See also 20000025351

Contract(s)/Grant(s): NCC2-926; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The bulk behavior of dispersed, fluidized, or undispersed stationary granular systems cannot be fully understood in terms of adhesive/cohesive properties without understanding the role of electrostatic forces acting at the level of the grains themselves. When grains adhere to a surface, or come in contact with one another in a stationary bulk mass, it is difficult to measure the forces acting on the grains, and the forces themselves that induced the cohesion and adhesion are changed. Even if a single gain were to be scrutinized in the laboratory, it might be difficult, perhaps impossible, to define the distribution and character of surface charging and the three- dimensional relationship that charges (electrons, holes) have to one another. The hypothesis that we propose to test in microgravity (for dielectric materials) is that adhesion and cohesion of granular matter are mediated primarily by dipole forces that do not require the presence of a net charge; in fact, nominally electrically neutral materials should express adhesive and cohesive behavior when the neutrality results from a balance of positive and negative charge carriers. Moreover, the use of net charge alone as a measure of the electrical nature of grain-to-grain relationships within a granular mass may be misleading. We believe that the dipole forces arise from the presence of randomly-distributed positive and negative fixed charge carriers on grains that give rise to a resultant dipole moment. These dipole forces have long-range attraction. Random charges are created whenever there is triboelectrical activity of a granular mass, that is, whenever the grains experience contact/separation sequences or friction. Electrostatic forces are generally under-estimated for their role in causing agglomeration of dispersed grains in particulate clouds, or their role in affecting the internal frictional relationships in packed granular masses. We believe that electrostatic, in particular dipole-mediated processes, are pervasive and probably affect, at some level, everything from astrophysical-scale granular systems such as interstellar nebulae, protoplanetary dust and debris disks, planetary-scale systems such as debris palls from meteorite impact, volcanic eruptions, and aeolian dust storms, all the way to industrial-scale systems in mining, powder and grain processing, pharmaceuticals, and smoke-stack technologies. NASA must concern itself with the electrostatic behavior of dust and sand on Mars because of its potentially critical importance to human exploration. The motion and adhesion of martian surface materials will affect the design and performance of spacesuits, habitats, processing plants, solar panels, and any externally exposed equipment such as surface rovers or communication and weather stations. Additionally, the adhesion of dust and sand could greatly enhance contact with the potentially toxic components of the martian soil.

Derived from text

Adhesion; Cohesion; Dipole Moments; Dust; Electrostatics; Granular Materials; Mars Surface; Microgravity; Sands; Soils; Surface Properties; Experiment Design; Mars (Planet)

20000025440 NASA Marshall Space Flight Center, Huntsville, AL USA

Microgravity Processing and Photonic Applications of Organic and Polymeric Materials

Frazier, Donald 0, NASA Marshall Space Flight Center, USA; Penn, Benjamin G., NASA Marshall Space Flight Center, USA; Smith, David, NASA Marshall Space Flight Center, USA; Witherow, William K., NASA Marshall Space Flight Center, USA; Paley, M. S., NASA Marshall Space Flight Center, USA; Abdeldayem, Hossin A., NASA Marshall Space Flight Center, USA; Jan. 26, 1998; 1p; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

In recent years, a great deal of interest has been directed toward the use of organic materials in the development of high-efficiency optoelectronic and photonic devices. There is a myriad of possibilities among organic which allow flexibility in the design of unique structures with a variety of functional groups. The use of nonlinear optical (NLO) organic materials such as thin-film waveguides allows full exploitation of their desirable qualities by permitting long interaction lengths and large susceptibilities allowing modest power input. There are several methods in use to prepare thin films, such as Langmuir-Blodgett (LB) and self-assembly techniques, vapor deposition, growth from sheared solution or melt, and melt growth between glass plates. Organics have many features that make Abstract: them desirable for use in optical devices such as high second- and third-order nonlinearities, flexibility of molecular design, and damage resistance to optical radiation. However, their use in devices has been

hindered by processing difficulties for crystals and thin films. In this chapter, we discuss photonic and optoelectronic applications of a few organic materials and the potential role of microgravity on processing these materials. It is of interest to note how materials with second- and third-order nonlinear optical behavior may be improved in a diffusion-limited environment and ways in which convection may be detrimental to these materials. We focus our discussion on third-order materials for all-optical switching, and second-order materials for all-optical switching, and second-order materials for frequency conversion and electrooptics.
Author
Microgravity; Photonics; Organic Materials; Radiation Spectra; Optical Properties; Optical Materials; Electro-Optics; Crystal Growth; Ferroelectric Materials

20000025453 Georgia Inst. of Tech., George W. Woodruff School of Mechanical Engineering, Atlanta, GA USA
Non-Coalescence Effects in Microgravity, *17 Jun. 1996 - 16 Jun. 1997*
Neitzel, G. Paul, Georgia Inst. of Tech., USA; May 1997; 44p; In English
Contract(s)/Grant(s): NAG3-1894; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Non-coalescence of two bodies of the same liquid and the suppression of contact between liquid drops and solid surfaces is being studied through a pair of parallel investigations being conducted at the Georgia Institute of Technology and the Microgravity Research and Support (MARS) Center in Naples, Italy. Both non-coalescence and contact suppression are achieved by exploiting the mechanism of thermocapillary convection to drive a lubricating film of surrounding gas (air) into the space between the two liquid free surfaces (non-coalescence) or between the drop free surface and the solid (contact suppression). Experiments performed to date include flow visualization experiments in both axisymmetric and (nearly) two-dimensional geometries and quantitative measurements of film thickness in the contact-suppression case in both geometries.
Derived from text
Coalescing; Microgravity; Retarding

20000025792 NASA Glenn Research Center, Cleveland, OH USA
Principal Investigator Microgravity Services Role in ISS Acceleration Data Distribution
McPherson, Kevin, NASA Glenn Research Center, USA; December 1999; 18p; In English; 38th; 38th Aerospace Sciences Meeting, 10-13 Jan. 2000, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 398-95-OG
Report No.(s): NASA/TM-1999-209774; NAS 1.15:209774; AIAA Paper 2000-0572; E-120-54; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Measurement of the microgravity acceleration environment on the International Space Station will be accomplished by two accelerometer systems. The Microgravity Acceleration Measurement System will record the quasi-steady microgravity environment, including the influences of aerodynamic drag, vehicle rotation, and venting effects. Measurement of the vibratory/transient regime comprised of vehicle, crew, and equipment disturbances will be accomplished by the Space Acceleration Measurement System-II. Due to the dynamic nature of the microgravity environment and its potential to influence sensitive experiments, Principal Investigators require distribution of microgravity acceleration in a timely and straightforward fashion. In addition to this timely distribution of the data, long term access to International Space Station microgravity environment acceleration data is required. The NASA Glenn Research Center's Principal Investigator Microgravity Services project will provide the means for real-time and post experiment distribution of microgravity acceleration data to microgravity science Principal Investigators. Real-time distribution of microgravity environment acceleration data will be accomplished via the World Wide Web. Data packets from the Microgravity Acceleration Measurement System and the Space Acceleration Measurement System-II will be routed from onboard the International Space Station to the NASA Glenn Research Center's Telescience Support Center. Principal Investigator Microgravity Services' ground support equipment located at the Telescience Support Center will be capable of generating a standard suite of acceleration data displays, including various time domain and frequency domain options. These data displays will be updated in real-time and will periodically update images available via the Principal Investigator Microgravity Services web page.
Author
Microgravity; Acceleration Measurement; Data Acquisition; Data Processing

20000026317 NASA Johnson Space Center, Houston, TX USA
Evaluation of Factors Affecting Powdered Drug Reconstitution in Microgravity
Schaffner, Grant, Harvard Medical School, USA; Johnston, Smith, NASA Johnson Space Center, USA; Marshburn, Tom, NASA Johnson Space Center, USA; KC-135 and Other Microgravity Simulations; August 1999, pp. 65-72; In English; See also 20000026303; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

Owing to the high cost of transporting mass into space, and the small volume available for equipment in the Space Shuttle Orbiter and the International Space Station, refrigeration space is extremely limited. For this reason, there exists strong motivation for transporting certain drugs in powdered form so that they do not require refrigeration. When needed, the powdered drug will be mixed with saline to obtain a liquid form that may be injected intravenously. While this is a relatively simple task in a 1-G environment, there are some difficulties that may be encountered in 0-G. In non-accelerated spaceflight, gravitational and inertial forces are eliminated allowing other smaller forces, such as capillary forces and surface tension, to dominate the behavior of fluids. For instance, water slowly ejected from a straw will tend to form a sphere, while fluid in a container will tend to wet the inside surface forming a highly rounded meniscus. Initial attempts at mixing powdered drugs with saline in microgravity have shown a tendency toward forming foamy emulsions instead of the desired homogeneous solution. The predominance of adhesive forces between the drug particles and the interface tensions at the gas/liquid and solid/liquid interfaces drastically reduce the rate of deaggregation of the drug powder and also reduce the rate of absorption of saline by the powder mass. In addition, the capillary forces cause the saline to wet the inside of the container, thus trapping air bubbles within the liquid. The rate of dissolution of a powder drug is directly proportional to the amount of surface area of the solid that is exposed to liquid solvent. The surface area of drug that is in contact with the liquid is greatly reduced in microgravity and, as a result, the dissolution rate is reduced as well. The KC-135 research described here was aimed at evaluating the extent to which it is possible to perform drug reconstitution in the weightlessness of parabolic flight using standard pharmacological supplies. The experiment included a parametric assessment of possible factors affecting the reconstitution process. The specific questions that we wished to answer were: (1) Is it possible to reconstitute powdered drugs in weightlessness using standard pharmacological equipment? (2) What are the differences between drug reconstitution in a 1-G and a 0-G environment? (3) What techniques of mixing the drug powder and diluent are more successful? (4) What physical and chemical factors play a role in determining the success of mixing and dissolution? (5) Is it necessary to employ crewmember and equipment restraints during the reconstitution process?
Author
Diluents; Dissolving; Drugs; Microgravity; Pharmacology; Powder (Particles); Aerospace Medicine

20000026321 Embry-Riddle Aeronautical Univ., Daytona Beach, FL USA
Undergraduate Program Flights: The Mixing of Intravenous Fluids in a Micro-Gravity Environment
Nieves–Suarez, Lisnnette M., Embry-Riddle Aeronautical Univ., USA; Thouvenel–Romans, Stephanie, Embry-Riddle Aeronautical Univ., USA; Springer, Ed, Embry-Riddle Aeronautical Univ., USA; Nair, Shiju, Embry-Riddle Aeronautical Univ., USA; KC-135 and Other Microgravity Simulations; August 1999, pp. 89-92; In English; See also 20000026303; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The objective of this experiment is to determine how two different fluids interact in an artificial vascular system in a free fall environment. Two series of experiments will be conducted. A first series of data sets will be collected in normal gravity conditions (1g) and a second set of data will be collected in micro-gravity. The purpose of this experiment is to see how two different fluid flows behave and interact in reduced-gravity. The data will be taken in form of visual observation using a video camera and high-speed digital camera attached to the box. The observations will include the rate and the way of mixing fluids, speed and intensity will be recorded on video camera, while the digital camera will show detailed phases of the mixing. The expected result of the experiment is to observe the rapid, homogeneous mixing of the fluids, however, in micro-gravity the behavior of fluids can change. Among the possible results are the formation of bubbles of fluid, air bubbles or the formation of eddy currents. The reason for those assumptions is NASA's observed behavior of fluid in reduced gravity. The blood will tend to distribute differently in micro-gravity, with more pressure in the head and chest.
Derived from text
Blood; Cardiovascular System; Fluid Flow; Microgravity; Simulation

20000027404 Georgia Inst. of Tech., School of Aerospace Engineering, Atlanta, GA USA
Acoustic Shaping in Microgravity: Technology Issues
Wanis, S., Georgia Inst. of Tech., USA; Komerath, N. M., Georgia Inst. of Tech., USA; Space Resources Utilization Roundtable; 1999, pp. 41-42; In English; See also 20000027384; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Through student participation in NASA flight tests, we have demonstrated the feasibility of forming complex and useful shapes in microgravity from pulverized material using sound waves, and correlated the shapes to mathematical predictions. The demonstrated potential is exciting, but the concept requires scientific studies before engineering design tools can be developed. The basics of the technology. the results to-date, and the outstanding issues are summarized.
Author
Microgravity; Sound Waves; Surface Geometry; Technology Assessment

20000027530 NASA Marshall Space Flight Center, Huntsville, AL USA
Microgravity Studies Offer Insights into Solidification Phenomena and Processing of Metals and Alloys
Grugel, Richard N., NASA Marshall Space Flight Center, USA; [1999]; 1p; In English; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The paper reviews historical aspects of solidification processing and the detrimental attributes associated with gravity-driven flow phenomena. Benefits of and avenues toward conducting experiments in a microgravity environment are presented and illustrated with relevant examples. Finally, some comments regarding the role of microgravity experimentation are given
Author
Metals; Microgravity; Solidification; Gravitational Effects; Alloys

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.

20000025534 National Science Council, Taipei, Taiwan, Province of China
Proceedings of the National Science Council, Republic of China, Volume 23, Physical Science and Engineering *Monthly Report*
Peng, S. M.; Nov. 1999; 156p; In English
Report No.(s): PB2000-102693; Copyright; Avail: National Technical Information Service (NTIS)

Partial Contents: Satellite Hole Spectral Method and its Applications to Dye-DNA Complexes (Invited Review Paper); Elastic Wave Propagation and Nondestructive Evaluation of Materials (Invited Review Paper); Adjustable Frequency Dielectric Resonator Antenna; A Portable Parallelizing Compiler with Loop Partitioning; A Progressive Constraint Search Approach for Disparity Matching in Stereo Vision; and Identification of Ionic Solutions Using a SAW Liquid Sensor.
NTIS
Conferences; Spectra; Wave Propagation

20000025774 Virginia Transportation Research Council, Charlottesville, VA USA
Research on Design for Prevention of Ditch Erosion on Virginia Highways *Final Report, Apr. 1998 - Jun. 1999*
Diplas, P.; Duncan, J. M.; Mitchell, J. K.; Coffey, J.; Smith, C.; Dec. 1999; 64p; In English
Report No.(s): PB2000-102816; VTRC-00-CR2; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Roadside ditch erosion has been problematic on Virginia highways. VDOT, through the Virginia Transportation Research Council, requested that roadside ditch erosion be investigated by means of a research project. Virginia Tech was selected to conduct this study. In support of this research, design guidance documents were surveyed to learn the current established policy and procedures for soil data collection and reporting, and the design practice for hydrologic and hydraulic analyses of roadside ditches. Site visits to each of Virginia's nine construction districts were made to interview district personnel about their personal experience with roadside ditch design, performance, and erosion failures. Current ditch design practices in nine other states were investigated through the collection and survey of state drainage manuals, and phone interviews with DOT personnel. Finally, an extensive review of current literature was performed with the intent of investigating current research on ditch erosion and erosion control.
NTIS
Highways; Soil Erosion; Ditches; Data Acquisition; Drainage; Erosion

20000027401 Colorado School of Mines, Center for Commercial Applications of Combustion in Space, Golden, CO USA
Self-Propagating High-Temperature Synthesis for In-Situ Materials Processing
Schowengerdt, F. D., Colorado School of Mines, USA; Moore, J. J., Colorado School of Mines, USA; Space Resources Utilization Roundtable; 1999, pp. 35; In English; See also 20000027384; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Large-scale construction and manufacturing on the Moon or Mars, if done by conventional means, will require massive amounts of energy. Because the payload masses would be prohibitive, this energy will not come from either solar panels or fuel cells. For habitat construction and large-scale manufacturing in-situ, existing raw materials must be used for both the energy and the products. One of the most promising processes for in-situ resource utilization on the Moon and Mars is self-propagating high-temperature synthesis (SHS), which is driven by exothermic reactions in packed starting powders. The end products often

have unique microstructure and high porosity. SHS is attractive for materials production in remote space environments because: 1) no external energy is required to sustain the process; 2) atmospheric oxygen is not needed; 3) the powders can be packed into near-net shapes for subsequent forming and machining; and 4) the starting compounds are likely to exist on the Moon and Mars. The process could be used to manufacture habitat structural elements, insulation, filters, machine tools and a wide variety of machine parts.
Author
Self Propagation; High Temperature; Refractory Materials; Manufacturing; Lunar Atmosphere

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.

20000025309 Air Force Inst. of Tech., School of Systems and Logistics, Wright-Patterson AFB, OH USA
Command and Control of Mobility Forces: Analysis of the Organizational Structure
Hupy, Jeffrey L.; Jun. 1999; 61p; In English
Report No.(s): AD-A372441; AFIT/GOM/LAC/99E-6; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Documents such as Joint Vision 2010 and Air Force 2025 outline military capabilities which the US will need to address National Interests in the near future. Most of these papers espouse decentralized control as a means to improve decision-making speed. As the USAF adds Global Air Traffic Management's required communications equipment to its mobility fleet, they must reconcile the difference between centralized control for efficiency and decentralized control for effectiveness. The existing command and control (C2) organizational structure must be modified to leverage the technological advantages. Rather than blindly invest in facility based equipment, the AF needs a plan based on the total system needs. A network organization balances the need for decentralized control with the most efficient use of the communications equipment to link the decision makers to the execution assets. Instead of investing in multiple C2 centers, the AF should consolidate its mobility dispatch functions into one location. One consolidated dispatch center provides the benefits of economies of scale and a one stop shop for the warfighter. The consolidated dispatch center does not eliminate the theater mobility planning staff. Rather, it allows the theater mobility experts focus on improving the integration and results of the mobility effort for the CINC without the data entry work of the dispatching center.
DTIC
Command and Control; Communication Networks; Controllers; Decision Support Systems

20000025396 Northrop Grumman Corp., Electronic Sensors and Systems Div., Baltimore, MD USA
Thermal Analysis and Design of a Phased Array Antenna
Marthinuss, James E., Jr., Northrop Grumman Corp., USA; Ninth Thermal and Fluids Analysis Workshop Proceedings; November 1999, pp. 153-165; In English; See also 20000025387; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper will address the thermal analysis and design process for a generic phased array antenna that is liquid cooled. Much of the information is based on the knowledge and experience gained during the thermal design of advanced phased array antennas done at Northrop Grumman. Design and analysis procedures from the GaAs chip heat source to the entire array will be discussed. Computational finite difference using Northrop Grumman developed Direct Numerical Simulation (DNS) to solve complex geometric shapes will be shown. Lessons learned and critical issues in the design process will be shown and their impact on design. This paper will allow an inexperienced thermal engineer to understand the important issues in the design and thermal analysis of a phased array antenna. The same techniques can also be applied for thermal analysis of many different electronic packages because many of the same items are critical to the design.
Author
Thermal Analysis; Phased Arrays; Antenna Design; Liquid Cooling

20000025471 Defence Research Board, Ottawa, Ontario Canada
A Comparison of Side-Lobe Cancellation Techniques Using Auxiliary Horizontal and Vertical Antennas in HF Surface Wave Radar
Leong, Hank W.; Nov. 1999; 39p; In English
Report No.(s): AD-A372444; DREO-TM-1999-121; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Side-lobe cancellation techniques are evaluated using auxiliary horizontal and vertical antennas in HF surface wave radar (HFSWR). The aim of the evaluation is to compare the pros and cons of using horizontal dipoles or vertical monopoles as auxiliary antennas in HFSWR. A radar experiment was carried out to facilitate this comparison. Four horizontal dipoles, configured in the form of two separate crosses, and six vertical monopoles of a HFSWR system were used in the experiment. In this report, the central four monopoles are used as main antennas, and either two of the horizontal dipoles or the other two vertical monopoles are used as auxiliary antennas. A synthetic target signal was injected into the radar data. The effects of the cancellation techniques on the target signal are evaluated. As expected, if the target signal is coming from the same direction as the interfering signal, it is cancelled when the vertical monopoles are used as auxiliary antennas. The same target signal, however, is still visibly present when the auxiliary horizontal dipoles are used. This latter result was obtained in spite of the fact that the horizontal antennas also received the radar signal.
DTIC
Dipole Antennas; Surface Waves; Sidelobes; High Frequencies; Radar Data

20000025495 Texas Univ., Dept. of Electrical and Computer Engineering, Austin, TX USA
Application of Model-Based Signal Processing Methods to Computational Electromagnetics Simulators ***Annual Report, 1 Dec. 1998 - 30 Nov. 1999***
Ling, Hao; Dec. 30, 1999; 214p; In English
Contract(s)/Grant(s): N00014-98-1-0178
Report No.(s): AD-A372423; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche
This report summarizes the scientific progress on the research grant "Application of Model-Based Signal Processing Methods to Computational Electromagnetics Simulators" during the period 1 December 1998 - 30 November 1999. Progress on model-based extrapolation and interpolation of complex radiation and scattering data in frequency and aspect is described.
DTIC
Signal Processing; Computational Electromagnetics; Simulators

20000025550 Space and Naval Warfare Systems Command, San Diego, CA USA
Rough Surface Propagation Effects at Wallops Island, February-April 1994 ***Final Report***
Hitney, H. V.; Nguyen, T.; Thornton, W. D.; Dec. 1999; 28p; In English
Report No.(s): AD-A371865; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
An unresolved radio propagation modeling problem is the effect of a wind-roughened sea surface on propagation at microwave frequencies in the evaporation duct. The biggest deficiency is the lack of suitable experimental data to validate various existing models. In 1994, the Naval Surface Warfare Center Dahlgren Division (NSWCDD) performed a radio propagation and meteorological measurement program at Wallops Island, Virginia, based on their Microwave Propagation Measurement System (MPMS). MPMS consists of 10 transmitters and 4 receivers using 16 discrete frequencies from 2 to 18 GHz. In the 1994 experiment, a 29.4-km over-water coastal propagation path that was over the horizon for the lowest sited transmitters and receivers was used. In this report, these data are analyzed specifically to investigate the effects of a rough sea surface on propagation in the evaporation duct.
DTIC
Surface Roughness; Ocean Surface; Wave Propagation; Electromagnetic Wave Transmission

20000025580 Research Inst. of National Defence, Dept. of Command and Control Warfare Technology, Linkoeping, Sweden
Simulation of Jammed Passive Electro-Optical Trackers ***Simulering av Stoerning mot Passiva Elektro-Optiska Malfoerljare***
Wigren, C.; Tyden, L.; Hedberg, C.; Jun. 1999; 116p; In Swedish
Report No.(s): PB2000-103058; FOA-R-99-01164-616-SE; No Copyright; Avail: National Technical Information Service (NTIS)
Using the simulation package called OPSIM, an investigation of how an imaging tracker can be jammed and a first test of the simulation method used in OPTSIM has been carried out. A comparison has been made between the results obtained using an imaging tracker and results obtained using a reticle seeker. The results show that the use of flares is effective against reticle seekers but not against imaging trackers of a correlation type. In the latter case it is possible to protect the object by using laser jammers. The results proved the simulation method used in OPTSIM to be flexible, reproducible, and give the user a flexible amount of control over the simulation.
NTIS
Computerized Simulation; Electro-Optics; Imaging Techniques; Control Simulation

20000025588 Nippon Telegraph and Telephone Public Corp., Basic Research Labs., Tokyo, Japan

Quantum Information Processing: Quantum Cryptography Toward Ultimate Security

Shimizu, Kaoru, Nippon Telegraph and Telephone Public Corp., Japan; Imoto, Nobuyuki, Graduate Univ. for Advanced Studies, Japan; NTT Review; January 2000; Volume 12, No. 1, pp. 26-31; In English; See also 20000025584; Copyright; Avail: Issuing Activity

Recent progress in digital computer communication networks has increased the awareness of the importance of information security technologies for private communications, message authentication, and data protection. NTT Basic Research Laboratories is pushing towards the realization of quantum cryptography, an innovative new concept of cryptography based on the principles of quantum mechanics. If a quantum cryptographic system can be successfully developed, there will be absolutely no possibility of security violations in private communications.

Author

Quantum Mechanics; Cryptography; Data Processing; Computer Information Security; Communication Networks

20000025591 Massachusetts Inst. of Tech., Lincoln Lab., Lexington, MA USA

Proceedings of the Adaptive Sensor Array Processing (ASAP) Workshop, Volume 1

Pelley, Cindy J., Editor, Massachusetts Inst. of Tech., USA; Jul. 09, 1999; 114p; In English; 7th; Adaptive Sensor Array Processing, 10-11 Mar. 1999, Lexington, MA, USA; See also 20000025592 through 20000025610

Contract(s)/Grant(s): F19628-95-C-0002; AF Proj. 0682

Report No.(s): AD-A367050; ASAP-7-Vol-1; ESC-TR-98-054-Vol-1; No Copyright; Avail: CASI; A02, Microfiche; A06, Hardcopy

This year marks the seventh annual ASAP (Adaptive Sensor Array Processing) workshop, which is sponsored jointly by the DARPA (Defense Advanced Research Projects Agency) Sensor Technology and Tactical Technology Offices, the Navy AEGIS and E2C Program Offices, and the NAVSEA (Naval Sea System Command) Advanced Systems and Technology Office. This joint sponsorship reflects the far-reaching implications of adaptive sensor array processing for a wide range of military applications. As this workshop has evolved over its seven year history, a Common theme has been to highlight the similarity of adaptive sensor processing techniques for various disciplines. The ASAP forum has allowed researchers from academia, government, and industry to discuss common problems, developing ideas, and solutions related to how these diverse technologies can be applied to national defense interests. This year will continue to stress the strong coupling between the radar, sonar, and communications communities. A key theme will be the system implications of adaptive signal processing techniques. it is hoped that the cross-fertilization of ideas at ASAP will provide new areas of exploration and accelerate technological advances benefitting national defense interests. MIT Lincoln Laboratory also hosts an Important companion forum called the High Performance Embedded Computing (HPEC) Workshop which focuses on embedded computing architectures for real-time implementation of advanced adaptive signal processing techniques. This year HPEC will be held on 22-23 September-1999. The ideas presented in HPEC provide the essential link for allowing the advances highlighted in the ASAP workshop to be applied in real systems.

Author

Signal Processing; Adaptation; Conferences; Antenna Arrays; Navy

20000025592 Massachusetts Inst. of Tech., Lincoln Lab., Lexington, MA USA

Circular Array STAP

Zatman, Michael, Massachusetts Inst. of Tech., USA; Circular Array STAP; Jul. 09, 1999; Volume 1, pp. 1-6; In English; See also 20000025591

Contract(s)/Grant(s): F19628-95-C-0002; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Traditionally, Space-Time Adaptive Processing (STAP) has been applied to uniform linear arrays (ULAs). However, when considering the overall radar system, electronically scanned circular arrays have advantages: a better combination of even and continual angular and temporal coverage, and mechanical simplicity because it does not need to rotate. The unanswered question about circular arrays is their suitability for STAP. This paper shows that for the airborne early warning (AEW) mission, circular arrays are indeed STAP compatible. However, from the STAP perspective there may be a small loss in performance when compared to a ULA. With some care in the choice and implementation of the STAP algorithm, the majority of the degradation is at close ranges, where the target returns are relatively strong. At long ranges the performance is barely affected.

Author

Linear Arrays; Early Warning Systems; Algorithms; Signal Processing; Space-Time Functions

20000025593 Science Applications International Corp., Arlington, VA USA

Principal Components, Covariance Matrix Tapers and the Interference Modulation Problems

Guerci, J. R., Science Applications International Corp., USA; Bergin, J. S., Information Systems Labs., Inc., USA; Proceedings of the Adaptive Sensor Array Processing (ASAP) Workshop; Jul. 09, 1999; Volume 1, pp. 7-11; In English; See also 20000025591; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

In this paper, a new approach to adaptive interference mitigation is presented which combines the principal components (PC) method with the concept of a covariance matrix taper (CMT). The PC-CMT method is shown to preserve the minimal sample support property of the PC method even when there is significant eigenspectrum spreading of the dominant interference subspace. In addition to demonstrating its utility for STAP applications, a novel inverse CMT (ICMT) method is suggested for eigen based direction finding applications for which signal modulation is an issue.

Author

Matrices (Mathematics); Covariance; Modulation; Algorithms; Electromagnetic Interference

20000025594 Information Systems Labs., Inc., Vienna, VA USA

Site-Specific Performance Bounds for Interference Mitigation in Airborne Radar Systems

Techau, P. M., Information Systems Labs., Inc., USA; Guerci, J. R., Science Applications International Corp., USA; Slocumb, T. H., Science Applications International Corp., USA; Griffiths, L. J., George Mason Univ., USA; Proceedings of the Adaptive Sensor Array Processing (ASAP) Workshop; Jul. 09, 1999; Volume 1, pp. 13-18; In English; See also 20000025591; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

This paper addresses the problem of interference suppression in airborne radar systems. Both hot clutter that is induced by interfering sources and cold clutter that results from the radar transmitter are considered. A new method is presented that allows calculation of the space-time covariance matrix that will be observed under specific topographical conditions. The method incorporates phenomenology observed under site-specific conditions as well as system effects such as array geometry, receiver filtering, and system bandwidth. This approach differs significantly from the usual approach in which sampled-data analysis is used to estimate the covariance matrix. The new approach allows direct calculation of the degree to which spacetime adaptive processing can be used to mitigate hot and cold clutter components for a specific heterogeneous terrain environment. From these results, one can infer performance bounds which are tighter and thus more meaningful than the thermal noise floor limit.

Author

Airborne Radar; Radar Transmitters; Electromagnetic Interference; Data Systems

20000025595 Lockheed Martin Federal Systems, Manassas, VA USA

Characterization of LMS and DMR Beamformers in the Presence of Loud Periodic Interferers

Street, Geoffrey C., Lockheed Martin Federal Systems, USA; Bell, Kristine, George Mason Univ., USA; Proceedings of the Adaptive Sensor Array Processing (ASAP) Workshop; Jul. 09, 1999; Volume 1, pp. 19-24; In English; See also 20000025591; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

Sonar system adaptive array processing is designed for slowly varying noise fields. The rapid expansion of deepwater offshore oil exploration has introduced loud impulsive periodic interferers into these systems. Standard LMS (Least Mean Squares) adaptive beamforming algorithm do not effectively eliminate these types of sources. In this paper we propose and examine the performance of several adaptive beamforming techniques designed to mitigate both periodic and static interference.

Author

Beamforming; Mean Square Values; Algorithms; Adaptation; Loudness; Electromagnetic Interference

20000025596 Raytheon Systems Co., Adaptive and Signal Processing, El Segundo, CA USA

Effects of Array Configuration on Circular Array STAP Performance

Unpingco, Jose H., Raytheon Systems Co., USA; Miller, Thomas W., Raytheon Systems Co., USA; Proceedings of the Adaptive Sensor Array Processing (ASAP) Workshop; Jul. 09, 1999; Volume 1, pp. 25-29; In English; See also 20000025591; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

In this paper, we consider how variation in the sector size of a circular array affects STAP (Space Time Adaptive Processing) performance for PRI-Staggered STAP. Sector size influences the achievable sidelobe level and to a lesser extent, detection sensitivity and metric accuracy As the sector size increases, the ability to control the sidelobes and cancel clutter/interference improves due to the increase in the number of degrees of freedom. In this paper, we study the effects of sector size with respect

to PRI-Staggered STAP in terms of SINR (Signal to Noise Ratio), detectable velocities, clutter covariance eigenvalues, and usable Doppler space fraction. Additionally, we illustrate the problem of misalignment and training region size on STAP performance.
Author
Space-Time Functions; Antenna Arrays; Antenna Design; Circles (Geometry)

20000025597 Mitre Corp., Bedford, MA USA
Synthesis of Adaptive Monopulse Patterns
Fante, Ronald L., Mitre Corp., USA; Proceedings of the Adaptive Sensor Array Processing (ASAP) Workshop; Jul. 09, 1999; Volume 1, pp. 31-38; In English; See also 20000025591; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

A procedure is developed to simultaneously synthesize sum and difference patterns for Space-Time Adaptive Processing (STAP), in such a way that a specified monopulse slope after adaptation is achieved.
Author
Monopulse Radar; Synthesis; Pattern Recognition; Space-Time Functions

20000025598 Massachusetts Inst. of Tech., Lincoln Lab., Lexington, MA USA
Passive Surface/Submerged Discrimination in a Shallow Water Waveguide: SWellEX-1996 Experimental Results
Premus, V., Massachusetts Inst. of Tech., USA; Proceedings of the Adaptive Sensor Array Processing (ASAP) Workshop; Jul. 09, 1999; Volume 1, pp. 33-38; In English; See also 20000025591
Contract(s)/Grant(s): F19628-95-C-0002; No Copyright; Avail: CASI; A02, Microfiche; A02, Hardcopy

Passive acoustic discrimination of submarines from surface clutter in the littoral oceanic waveguide is a problem of paramount importance facing the U.S. Navy anti-submarine warfare (ASW) community. Investigators, have suggested that fluctuation statistics of the received pressure field may be used to distinguish surface and submerged passive acoustic sources. A statistical test based on probabilistic models for amplitude fluctuations of ray paths of surface and submerged origin was proposed. A lofargram normalization technique based on the short-time harmonic mean of FFT magnitude was also proposed. Recently, an approach based on the short time-scale scintillation of waveguide normal mode amplitudes was developed. Mode scintillation is induced by target interaction with surface waves and waveguide deformation associated with surface wave action. Mode scintillation has been demonstrated to possess distinct surface submerged potential for narrowband acoustic sources in a simulated littoral waveguide. In this paper, data from the ONR (Office of Naval Research)-sponsored shallow water experiment, SWellEX-96 (Shallow Water Evaluation Cell Experiment), is used to validate the proposed classification methodology and illustrate the basic phenomenology.
Author
Shallow Water; Waveguides; Surface Waves; Antisubmarine Warfare; Scintillation; Submerged Bodies

20000025599 Villanova Univ., Dept. of Electrical and Computer Engineering, PA USA
Trellis Structure Approach to Multitarget Tracking
Perry, Richard, Villanova Univ., USA; Vaddiraju, Anand, Villanova Univ., USA; Buckley, Kevin, Villanova Univ., USA; Proceedings of the Adaptive Sensor Array Processing (ASAP) Workshop; Jul. 09, 1999; Volume 1, pp. 39-44; In English; See also 20000025591
Contract(s)/Grant(s): N000014-98-1-0892; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

In this paper we address sequential multitarget tracking for Radar applications. Specifically, we consider the problem of associating location measurement data over time to form estimates of multiple tracks. The algorithmic approach we employ is sequential and very flexible in that it can handle missed detections, false alarms, track initiation, and number-of-track estimation, while employing maximum likelihood or Bayesian cost functions. The approach is based on a trellis diagram which depicts the possible progressions of sequences of location measurements overtime. Computation requirements are managed using a generalized K-path, L-list Viterbi algorithm to prune candidate track sets which have prohibitively high costs. Here we focus on a Bayesian solution to the joint problem of estimating both the number-of-tracks and the tracks themselves.
Author
Trellis Coding; Tracking Radar; Algorithms; Tracking (Position)

20000025600 Sanders Associates, Inc., Nashua, NH USA
Real CFAR: Nonparametric CFAR Detection Using Real Training Data
Real, E. C., Sanders Associates, Inc., USA; Tufts, D. W., Rhode Island Univ., USA; Proceedings of the Adaptive Sensor Array Processing (ASAP) Workshop; Jul. 09, 1999; Volume 1, pp. 45-49; In English; See also 20000025591; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

We present a method for estimating threshold values for signal detection and classification system in which a prescribed value of false alarm probability is needed. The threshold values are determined directly from real observed test statistic data without knowledge of the probability distribution of the data.
Author
False Alarms; Algorithms; Signal Detection; Estimating; Probability Theory

20000025601 George Mason Univ., Center of Excellence, Fairfax, VA USA
Quadratically Constrained RLS Filtering for Adaptive Beamforming and DS-CDMA Multi-User Detection
Tian, Zhi, George Mason Univ., USA; Bell, Kristine L., George Mason Univ., USA; VanTrees, Harry L., George Mason Univ., USA; Proceedings of the Adaptive Sensor Array Processing (ASAP) Workshop; Jul. 09, 1999; Volume 1, pp. 51-55; In English; See also 20000025591; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The Minimum Output Energy (MOE) detector used in Direct Sequence Code Division Multiple Access (DS-CDMA) communications systems is analogous to the Linearly Constrained Minimum Power (LCMP) beamformer used in array processing. In both applications, a quadratic constraint on the weight vector norm can improve robustness to mismatch in the temporal or spatial signature vector. We describe a technique for implementing a quadratic inequality constraint with Recursive Least Squares (RLS) updating using the Generalized Sidelobe Canceller (GSC) (also called the Partitioned Linear Interference Canceller (PLIC)) structure. A variable loading term is incorporated at each step, where the amount of loading has a closed form solution. Comparisons are made with several other robust RLS and Least Mean Squares (LMS) algorithms. Simulations show that the variable loading RLS technique offers better convergence and robust control over mismatch than other LMS and RLS implementations for both beamforming and multiuser detection.
Author
Beamforming; Code Division Multiple Access; Least Squares Method; Recursive Functions; Mathematical Models; Algorithms; Telecommunication

20000025602 Northeastern Univ., Boston, MA USA
Estimation of a Jammed Multipath Channel Delay Profile Using Superresolution Methods and a Random Path Decorrelation Technique
Bouchereau, Frantz, Northeastern Univ., USA; Brady, David, Northeastern Univ., USA; Lanzl, Colin, PinPoint Corp., USA; Proceedings of the Adaptive Sensor Array Processing (ASAP) Workshop; Jul. 09, 1999; Volume 1, pp. 57-62; In English; See also 20000025591; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

In this paper, we extend a superresolution PseudoNoise sequence correlation method (SPM) to the time delay profile estimation of a jammed multipath channel. SPM is based on the MUltiple SIgnal Classification (MUSIC) algorithm which assumes a decorrelated signal covariance matrix, therefore, successful decorrelation of the inherently coherent multipath-echos becomes a critical issue. Previously proposed path decorrelation techniques will fail in certain multipath environments and will be, in many cases, computationally expensive. We propose a decorrelation technique less likely to fail that will, in general, need fewer computations. We also propose a method that shortens the necessary snapshot transmission period and reduces the risk of channel variations during signal acquisition. Finally we show and analyze the results of underwater acoustic transmission experiments to which SPM was applied.
Author
Multipath Transmission; Channels (Data Transmission); Algorithms; Correlation; Time Lag; High Resolution; Random Noise

20000025603 Mitre Corp., Bedford, MA USA
Nulling Over Extremely Wide Bandwidths When Using Stretch Processing
Davis, Richard M., Mitre Corp., USA; Torres, Jose A., Mitre Corp., USA; Kramer, David R., Mitre Corp., USA; Fante, Ronald L., Mitre Corp., USA; Proceedings of the Adaptive Sensor Array Processing (ASAP) Workshop; Jul. 09, 1999; Volume 1, pp. 63-68; In English; See also 20000025591; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

This paper describes a technique for performing adaptive jammer nulling over extremely wide bandwidths that is applicable to radar spans which use linear frequency modulated (LFM) waveforms and stretch processing. It it assumed that the range uncertainty of the target is a small percentage of the equivalent range extent of the uncompressed pulse. The assumptions allow the cancellation to take place in either the time domain using a narrowband sliding filter that keeps up with the chirp rate or in the frequency domain. The new approach supports nulling performance over a gigahertz of bandwidth comparable to that previously achieved over a few megahertz using approximately the same number of degrees of freedom.
Author
Frequency Modulation; Waveforms; Broadband; Null Hypothesis; Jammers

20000025604 Raytheon Systems Co., Adaptive and Signal Processing Technology Center, El Segundo, CA USA

Angle of Arrival Estimation with a Polarization Diverse Array

Ballance, William P., Raytheon Systems Co., USA; Coan, Ralph A., Raytheon Systems Co., USA; Proceedings of the Adaptive Sensor Array Processing (ASAP) Workshop; Jul. 09, 1999; Volume 1, pp. 69-74; In English; See also 20000025591; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

In this paper we derive the Maximum-Likelihood Estimator (MLE) for angle of arrival (AOA) estimation for a general 3-dimensional array with arbitrarily polarized elements. Such an array requires joint estimation of the unknown source polarization as well as its AOA. The key is that polarization enters the model linearly, and hence a closed-form estimate can be computed. The result is that AOA estimation requires a search only over AOA, just as in the known-polarization case. The BWE (Beamform, Whiten, and Energy Detect) is shown to be the MLE for a single snapshot but not for multiple snapshots. The corresponding Cramer-Rao Bound (CRB) is derived and a simple example is used to show agreement. Moreover, an intuitive explanation for the impact that unknown polarization has on the shape of the MLE performance index, and therefore on AOA performance, is provided. Final1y, the effect of incorrectly assuming source polarization and attempting ”known-polarization ” AOA estimation is addressed.

Author

Maximum Likelihood Estimates; Three Dimensional Models; Mathematical Models; Antenna Arrays; Polarization (Waves)

20000025605 DSO National Labs., Singapore, Singapore

Distributed Electromagnetic Component Sensor Array Processing

See, Chong– Meng Samson, DSO National Labs., Singapore; Nehorai, Arye, Illinois Univ., USA; Proceedings of the Adaptive Sensor Array Processing (ASAP) Workshop; Jul. 09, 1999; Volume 1, pp. 75-79; In English; See also 20000025591

Contract(s)/Grant(s): F49620-97-1-0481; F49620-99-1-0067; N0014-98-1-0067; NSF MIP-96-15590; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

We propose an approach to localize multiple sources based on spatially distributed electric and magnetic component sensors. by jointly exploiting all available electromagnetic information as well as spatial diversity (time delays), this approach should outperform both a single vector sensor and scalar-sensor arrays in accuracy of direction of arrival (DOA) estimation.

Author

Electromagnetic Radiation; Antenna Arrays; Mathematical Models; Signal Processing; Spatial Distribution

20000025606 Massachusetts Inst. of Tech., Lincoln Lab., Lexington, MA USA

A Computationally-Efficient Two-Step Implementation of the GLRT

Pulsone, Nicholas B., Massachusetts Inst. of Tech., USA; Zatman, Michael A., Massachusetts Inst. of Tech., USA; Proceedings of the Adaptive Sensor Array Processing (ASAP) Workshop; Jul. 09, 1999; Volume 1, pp. 81-86; In English; See also 20000025591

Contract(s)/Grant(s): F19628-95-C-0002; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

In this paper the performance of a new two-step adaptive detection algorithm is analyzed. The two-step GLRT consists of an initial Adaptive Matched Filter (AMF) test followed by a Generalized Likelihood Ratio Test (GLRT). Analytical expressions are provided for the probability of false alarm (P (sub FA)) and the probability of detection (P (sub D)) in unknown interference modeled as a multivariate complex Gaussian process. The analysis shows that the two-step GLRT significantly reduces the computational load over the GLRT while maintaining detection and sidelobe rejection performance commensurate with the GLRT. The two-step GLRT detection algorithm is also compared to another two step detection algorithm, the Adaptive Sidelobe Blanker (ASB). Both the two-step GLRT and the ASB are Characterized in term of mainbeam detection performance and the rejection of sidelobe targets. We demonstrate that for a given P (sub FA) the two-step GLRT has a broad range of threshold pairs (one threshold for the AMF Test and one for the GLRT) that provide GLRT-like mainbeam detection performance. This is in contrast to the ASB, where the threshold pairs that maximize P (sub D) are a function of the target’s signal-to-interference-plus-noise ratio. Hence for a fixed pair of thresholds the two-step GLRT can provide slightly better mainbeam detection performance than the ASB in the transition region from low to high detection probabilities.

Author

False Alarms; Signal Detection; Algorithms; Computation; Likelihood Ratio

20000025607 Colorado Univ., Dept. of ECE, Boulder, CO USA

The Cosine GLRT: Comparison of this Scale-Invariant GLRT with the Kelly GLRT and the AMF

Kraut, Shawn, Colorado Univ., USA; Scharf, Louis L., Colorado Univ., USA; Proceedings of the Adaptive Sensor Array Processing (ASAP) Workshop; Jul. 09, 1999; Volume 1, pp. 87-92; In English; See also 20000025591

Contract(s)/Grant(s): N00014-89-J-1070; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

We examine the problem of ”adaptive” detection, wherein the noise covariance structure is unknown, and estimated with training data. We are specifically interested in noise that is not constrained to have the same power level in the test data and training data. For this scenario, we have shown that the ”cosine” statistic is the GLRT (Generalized Likelihood Ratio Test) under unknown noise covariance, a companion to the GLRT detector of Kelly. It is invariant to arbitrary scaling of both the training data matrix and the test data. These invariances also make it useful for compound-Gaussian noise scenarios, such as radar clutter modeled by a Gaussian noise process with an additional random amplitude scaling. We compare the performance of the cosine GLRT, or ACE (Adaptive Cosine Estimator), with the Kelly GLRT and AMF (Adaptive Matched Filter). We have shown that all adaptive detectors of this type have statistically equivalent representations in terms of concise expressions of five statistically independent, scalar random variables, only three of which are needed to completely describe the random fluctuations in the sample covariance. Using these representations, we compare the performance of the adaptive detectors when the noise scaling fluctuates.
Author

Likelihood Ratio; Scalars; Matched Filters; Cosine Series; Covariance; Random Noise

20000025608 Space and Naval Warfare Systems Command, Systems Center, San Diego, CA USA

Adaptive Doppler Processing Evaluated with SWAC Data Sets

Alsup, James, Space and Naval Warfare Systems Command, USA; Zabal, Xavier, Science Applications International Corp., USA; Proceedings of the Adaptive Sensor Array Processing (ASAP) Workshop; Jul. 09, 1999; Volume 1, pp. 93-98; In English; See also 20000025591; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

Pulsed single-frequency continuous wave (PCW) sonar echoes in the 1-3 knot range may be difficult to detect in littoral conditions due to the presence of bottom and surface reverberation. The adaptive Doppler processing (ADP) algorithm mitigates this difficulty by using signal-based estimates of the background to suppress reverberation and to help reveal otherwise obscured echoes in this Doppler range. Results we presented using data from the third Shallow Water Active Classification (SWAC-3) sea trial.
Author

Shallow Water; Algorithms; Doppler Effect; Continuous Radiation; Signal Processing

20000025609 Defense Information Systems Agency, Advanced Systems and Technology Office, Arlington, VA USA

A Fresh Look at ’Broadband’ Passive Sonar Processing

Zarnich, Robert E., Defense Information Systems Agency, USA; Proceedings of the Adaptive Sensor Array Processing (ASAP) Workshop; Jul. 09, 1999; Volume 1, pp. 99-104; In English; See also 20000025591; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

Traditional passive broadband sonar processing has been constructed by performing spatial decomposition (beamforming) followed by a temporal filter (Eckart weighting) structured to maximize deflection for signal present while minimizing deflection under noise only conditions. This processing, while approaching optimality in the stationary single signal-stationary noise case, is not well suited for clutter rich environments and spectrally diverse signal sets. Techniques such as the Smoothed Coherent Transform (SCOT) and the PHAse Transform (PHAT) as well as a new ad hoc construction referred to as Sub-band Peak Energy Detection or SPED are finding increased usage in modern sonar systems. This paper discusses sources of the performance gains over traditional processing. A conclusion that ’Passive Broadband’ is fundamentally a Direction of Arrival (DOA) estimation problem is developed from this analysis. Based on this conclusion higher resolution techniques including, Quadratic Spectral Capon and Spectral MUSIC (Multiple Signal Classification) are applied to generate a similar broadband output. A comparison of performance to the Navy’s current Broadband schemes against a common real data set is presented
Author

Broadband; Sonar; Signal Processing; Beamforming

20000025610 Duke Univ., Dept. of Electrical and Computer Engineering, Durham, NC USA

Over-the-Horizon Skywave Radar Target Localization

Anderson, Richard, Duke Univ., USA; Krolik, Jeffrey, Duke Univ., USA; Papazoglou, Michael, Duke Univ., USA; Proceedings of the Adaptive Sensor Array Processing (ASAP) Workshop; Jul. 09, 1999; Volume 1, pp. 105-110; In English; See also 20000025591

Contract(s)/Grant(s): N00014-93-1-0748; N00014-97-P-2107; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

Target localization using over-the-horizon skywave radar relies critically on correctly modeling and processing multipath returns. This paper deals with the use of both unresolved and resolved multipath arrivals in order to perform 3-D estimation of aircraft position. In particular, unresolved micro-multipath returns due to surface reflections local to the target are used for altitude

estimation and the combination of resolvable multipath arrivals from different layers of the ionosphere are used to enhance target latitude and longitude estimates. For altitude estimation, the maximum likelihood method presented here exploits a statistical model for the altitude-dependent complex fading of the target across radar revisits. For latitude and longitude determination, the proposed maximum and posteriori mode linker uses a statistical model of the ionosphere to achieve robust localization in the presence of uncertain channel characteristics. Real data results are presented for both methods which demonstrate that altitude can be estimated to within 3000 ft. and as much as a 3:1 improvement in ground coordinate accuracy can be achieved.
Author
Over-The-Horizon Radar; Sky Waves; Radar Targets; Mathematical Models; Maximum Likelihood Estimates; Position (Location)

20000026831 Swedish Inst. of Space Physics, Uppsala, Sweden
Radio Wave Propagation and Linear Resonance Absorption in an Inhomogeneous, Cold, Unmagnetised Plasma
Frenning, G., Swedish Inst. of Space Physics, Sweden; Apr. 1999; 58p; In English
Report No.(s): PB2000-102582; IRF-SR-258; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

Radio wave propagation in an inhomogeneous, cold, unmagnetized plasma is studied. It is shown that for propagation at an angle to the inhomogeneity gradient, the reflection characteristics strongly depend on the polarization of the wave. The case of an obliquely incident TE polarized electromagnetic (EM) wave is found to be very similar to the case of a vertically incident wave. However, an obliquely incident TM polarized EM wave is partly converted into an electrostatic (ES) mode, which is an example of mode conversion or resonance absorption. Using the WKB method, the mode conversion coefficient is computed analytically, and is expressed in terms of a phase integral. It is shown that the result agrees well with the results obtained by other authors.
NTIS
Radio Waves; Wave Propagation; Cold Plasmas; Wave Equations; Wentzel-Kramer-Brillouin Method; Radio Transmission; Polarization (Waves); Plasma Waves

20000027410 NASA Johnson Space Center, Houston, TX USA
Communications Between Crews on Mars and Scientists on Earth
Dickerson, Patricia W., Lockheed Martin Corp., USA; Budden, Nancy Ann, Lunar and Planetary Inst., USA; McKay, David S., NASA Johnson Space Center, USA; Spudis, Paul D., Lunar and Planetary Inst., USA; Frassanito, Jack; Keaton, Paul; Mars Field Geology, Biology. and Paleontology Workshop: Summary and Recommendations; [1998], pp. 31-37; In English; See also 20000027406; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

For the purpose of the following discussion, we assume that of the six crew members sent to Mars, at least three will be scientists. We further assume that geological and biological investigations will proceed together (although investigative techniques may vary), both for vestiges of ancient life, and for evidence of living organisms. Finally, unexpected discoveries may cause sudden changes in exploration strategies, and mission planning should be flexible enough to accommodate such shifts.
Author
Mission Planning; Manned Mars Missions; Mars (Planet); Interplanetary Communication; Mars Bases; Mars Surface

20000027599 Goeteborg Traffic Information Centre, Goeteborg, Sweden
Real-Time Information via Telephone: A GOTIC Project, No. 13
1999; 24p; In English; Original contains color illustrations
Report No.(s): PB2000-102602; GOTIC-RR-13; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report, no. 13 in the Gotic Research Reports series, summarizes the most important results and offers recommendations in support of the continued development of real-time services via the telephone. Two central aspects of the design of telematics-based services are the content of the services and the service's user-interface. Together they form the basis on which the customer/user's assessment of the quality of the service will be judged.
NTIS
Real Time Operation; Telephones

20000027622 Mitsubishi Electric Corp., Tokyo, Japan
Onboard Processing for Millimeter-Wave Personal Satellite Communications System
Komiyama, Norio, Mitsubishi Electric Corp., Japan; Endo, Minoru, Mitsubishi Electric Corp., Japan; Ishizu, Nobuo, Mitsubishi Electric Corp., Japan; Otsu, Yuichi, Mitsubishi Electric Corp., Japan; Katagiri, Hideki, Nippon Electric Co. Ltd., Japan; Akatsuka, Hiroshi, Nippon Electric Co. Ltd., Japan; Senba, Shinji, Nippon Electric Co. Ltd., Japan; Ohgushi, Yoshio, Nippon Electric Co. Ltd., Japan; [1987]; 6p; In English; Copyright; Avail: Issuing Activity

This paper describes the feasibility of a millimeter-wave personal satellite communications system for the first decade of the 21st century. An onboard processor with baseband switching allows the choice of the best multiple scheme: SCPC/FDMA (Single Channel Per Carrier/Frequency Division Multiple Access) for uplink and TDM (Time Division Multiples) for downlink. Demand assignment with 100 channels per beam could effectively serve tens of users. It is necessary to develop a lightweight onboard processor with these functions. A group demultiplexing method using Fast Fourier Transform (FFT), and a new switching architecture using address gates have been examined.
Author
Millimeter Waves; Onboard Data Processing; Airborne/Spaceborne Computers; Satellite Communication; Single Channel Per Carrier Transmission; Frequency Division Multiple Access

20000027645 Helsinki Univ. of Technology, Communications Lab., Espoo, Finland
Investigation of Data Transmission over an Adaptive Delta Modulated Voice Channel by Simulations Using a Spreadsheet Program
Lallo, P.; 1999; ISSN 0356-5087; 32p; In English; Original contains color illustrations
Report No.(s): PB2000-102685; ISBN 951-22-4770-4; Copyright; Avail: National Technical Information Service (NTIS)
This paper presents voice and data transmission simulations of the tactical telecommunication network. The network uses adaptive delta modulation (ADM) as the encoding method of analog signals. Recommendations are for digital data transmission and the use of analog standard modems is not recommended. Our measurements have demonstrated the present performance of the analog data transmission over ADM-channel. We have hardly acceptable bit error rates (BER) and the other effects of the ADM-channel parameters. Thus a special simulator was built using a worksheet program. We wanted to investigate delta modulation parameters and find out useful waveforms for the ADM-channel. Thus we modeled the channel and simulated its performance. In this report, we find out the effect of different ADM-parameters (step size, adaptation memory, and sample rate) on the quality of service(QOS) of the channel, the effect of some waveforms on BER vs S/N, and the selection of digital modulation method to give acceptable BER values for the available bandwidth of the ADM-channel. We consider some combinations of amplitude, frequency, and phase modulation, symbol time, symbol(modulation) rates, bit rates, and sample rates. We develop complex waveforms by simulations and use BER-values as QOS. In this report, we find that new non-standard waverforms have much better BER values in the ADM-channel than standard ITU-modems. According to our simulation results and some tests last year, we have demonstrated with our prototype modem using some new waveforms seamless data transmission through different analog and digital telecommunication networks with much higher bit rates than with standard ITU-T modems.
NTIS
Data Transmission; Delta Modulation; Simulation; Voice Communication; Communication 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.

20000025345 Washington State Univ., Pullman, WA USA
High-Speek Polymer Fiber Electrooptic Modulators and Devices ***Final Report, Mar. 1998-Feb. 1999***
Kuzyk, Mark G.; Dec. 10, 1999; 9p; In English
Contract(s)/Grant(s): F49620-98-1-0275; AF Proj. 3484
Report No.(s): AD-A372189; 2464-0298; AFRL-SR-BL-TR-00-0002; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
Funds from this grant were used to buy a continuous tunable laser source and electronics package that is being used for electrooptic modulation experiments in unique electrooptic fibers that are made in our laboratory. In addition, this proposed laser system compliments our present fiber characterization experiments that include linear absorption, scattering, refractive index, stimulated Brillouin scattering, quadratic electrooptic measurements, fluorescence, Photobleaching, and photoisomerization.
DTIC
High Polymers; Fiber Optics; Electro-Optics; Modulators; Optoelectronic Devices

20000025406 Dynamic Soft Analysis, Inc., Pittsburgh, PA USA

Thermal Management of Aero and Space Electronic Boards

Lazzaro, Greg, Dynamic Soft Analysis, Inc., USA; Andrikowich, Tom, Allied-Signal Aerospace Co., USA; Ninth Thermal and Fluids Analysis Workshop Proceedings; November 1999, pp. 131-137; In English; See also 20000025387; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The thermal management of electronic boards for aero and space applications must conform to severe requirements between limited heat removal options and limited weight tolerance. With the trend toward higher packaging, density in chips and faster clock speeds, the power dissipation of each component has increased over the last few decades. Also, the condensed system packaging has led to an increase in power per unit area on electronic boards. Thus, the most severe thermal management challenges occur in aerospace electronics where reliability issues are high and the means for heat removal are limited. As a result of these conditions, thermal analysis software must be an integrated step along with component placement, routing, electronic simulation, mechanical analysis, and reliability prediction. The use of thermal analysis software helps to identify thermal problems during the early stages of design. It also provides various options to resolve possible thermal problems during the design process. This process will reduce expensive corrections to prototypes by predicting the thermal performance before the first prototype is constructed. In routine product design. engineers generally use thermal analysis software along with other CAE software. A specific example of an aircraft engine control unit from Allied-Signal Aerospace is provided as an example. Modeling specifics and temperature comparisons between the software and test data will be presented.

Author

Thermal Analysis; Temperature Control; Aircraft Engines; Applications Programs (Computers); Aerospace Systems; Systems Integration

20000025469 Dundee Univ., Dept. of Applied Physics and Electronic and Mechanical Engineering, UK

Defect Characterization of Ultra-Small Devices ***Final Report, Sep. 1997 - Nov. 1998***

Keeble, David J.; Sep. 20, 1999; 43p; In English

Contract(s)/Grant(s): N6817171-97-M-5770

Report No.(s): AD-A372437; ERO-1F; ARDSG-R/D-8224-EE-01; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The work described here details the development of electron magnetic resonance facilities and measurements for use on US Army projects for the characterisation of electronic devices. An operational electrically-detected magnetic resonance (EDMR) spectrometer constructed has been installed based on a Bruker (Bmax = 2.1 T) electromagnet. The first spectra from device structures have been successfully recorded. A flexible modular spectrometer system has resulted and has led to further work to develop the instrumentation. Initial measurements on commercial silicon n+p diodes are consistent with previous studies. Evidence that the origin of the EDMR signal is due to platinum is assessed with the aid of spectral simulation. Electron paramagnetic resonance spectra were simulated by exact diagonalization of the appropriate spin-Hamiltonians. No completely satisfactory correspondence between reported EPR spectra and the measured and reported EDMR spectra was found. The long-term aim of the work is to study localization in quantum confined structures and to investigate electrically detected magnetic resonance for impurity and defect detection in operational device structures. Further, the possibility that the technique will give key insights into spin processes in semiconductors of direct relevance to the implementation of quantum computing devices will also be explored.

DTIC

Defects; Electron Paramagnetic Resonance; Electronic Equipment

20000025478 California Univ., Dept. of Electrical Engineering and Computer Science, Berkeley, CA USA

Advanced Silicon FET Physics and Device Structures ***Final Report, 1 Oct. 1994 - 30 Sep. 1998***

Hu, Chenming; Bokor, Jeffrey; Dec. 23, 1998; 7p; In English

Contract(s)/Grant(s): F49620-94-1-0464

Report No.(s): AD-A372474; AFRL-SR-BL-TR-00-0014; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The objectives of the project were to develop experimental techniques for characterizing the transport and hot carrier phenomena in advanced MOSFETs, to investigate the limits of gate oxide scaling, to develop engineering models for the relevant physical effects, and to incorporate the results in device simulators and in MOSFET models for circuit simulations. All the objectives have been met.

DTIC

Field Effect Transistors; Silicon

20000025490 NASA Marshall Space Flight Center, Huntsville, AL USA

TAL Performance and Mission Analysis in a CDL Capacitor Powered Direct-Drive Configuration

Hrbud, Ivana, NASA Marshall Space Flight Center, USA; Rose, M. Frank, NASA Marshall Space Flight Center, USA; Oleson, Steve R., NYMA, Inc., USA; Jenkins, Rhonald M., Auburn Univ., USA; [1999]; 52p; In English; Copyright Waived; Avail: CASI; A04, Hardcopy; A01, Microfiche

The goals of this research are (1) to prove the concept feasibility of a direct-drive electric propulsion system, and (2) to evaluate the performance and characteristics of a Russian TAL (Thruster with Anode Layer) operating in a long-pulse mode, powered by a capacitor-based power source developed at Space Power Institute. The TAL, designated D-55, is characterized by an external acceleration zone and is powered by a unique chemical double layer (CDL) capacitor bank with a capacitance of 4 F at a charge voltage of 400 V. Performance testing of this power supply on the TAL was conducted at NASA Lewis Research Center in Cleveland, OH. Direct thrust measurements of the TAL were obtained at CDL power levels ranging from 450 to 1750 W. The specific impulse encompassed a range from 1150 s to 2200 s, yielding thruster system efficiencies between 50 and 60%. Preliminary mission analysis of the CDL direct-drive concept and other electric propulsion options was performed for the ORACLE spacecraft in 6am/6pm and 12am/12pm, 300 km sun-synchronous orbits. The direct-drive option was competitive with the other systems by increasing available net mass between 5 and 42% and reducing two-year system wet mass between 18 and 63%. Overall, the electric propulsion power requirements for the satellite solar array were reduced between 57 and 91% depending oil the orbit evaluated The direct-drive, CDL capacitor-based concept in electric propulsion thus promises to be a highly-efficient, viable alternative for satellite operations in specific near-Earth missions.

Author

Chemical Engineering; Layouts; Capacitors; Drives; Efficiency; Mechanical Drives; Performance Tests

20000025507 NASA Pasadena Office, CA USA

Temperature Compensated Sapphire Resonator for Ultrastable Oscillator Operating at Temperatures Near 77 Deg Kelvin

Dick, G. John, Inventor, Jet Propulsion Lab., California Inst. of Tech., USA; Santiago, David G., Inventor, Jet Propulsion Lab., California Inst. of Tech., USA; Jun. 01, 1999; In English

Patent Info.: Filed 9 Aug. 1998; NASA-Case-NPO-19414-1-CU; US-Patent-5,909,160; US-Patent-Appl-SN-538433; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

A sapphire resonator for an ultrastable oscillator capable of substantial performance improvements over the best available crystal quartz oscillators in a compact cryogenic package is based on a compensation mechanism enabled by the difference between copper and sapphire thermal expansion coefficients for so tuning the resonator as to cancel the temperature variation of the sapphire's dielectric constant. The sapphire resonator consists of a sapphire ring separated into two parts with webs on the outer end of each to form two re-entrant parts which are separated by a copper post. The re-entrant parts are bonded to the post by indium solder for good thermal conductivity between parts of that subassembly which is supported on the base plate of a closed copper cylinder (rf shielding casing) by a thin stainless steel cylinder. A unit for temperature control is placed in the stainless steel cylinder and is connected to the subassembly of re-entrant parts and copper post by a layer of indium for good thermal conduction. In normal use, the rf shielding casing is placed in a vacuum tank which is in turn placed in a thermos flask of liquid nitrogen. The temperature regulator is controlled from outside the thermos flask to a temperature in a range of about 40K to 150K, such as 87K for the WGH-811, mode of resonance in response to microwave energy inserted into the rf shielding casing through a port from an outside source.

Author

Oscillators; Resonators; Sapphire; Temperature Control; Cryogenic Temperature

20000025585 Nippon Telegraph and Telephone Public Corp., Basic Research Labs., Tokyo, Japan

Single-Electron Device: An Ultimate Device That Operates on Just a Single Electron

Takahashi, Yasuo, Nippon Telegraph and Telephone Public Corp., Japan; NTT Review; January 2000; Volume 12, No. 1, pp. 12-16; In English; See also 20000025584; Copyright; Avail: Issuing Activity

As we approach a new age in which the amount of information communication is expected to increase explosively, energy-saving in communication processing has become an urgent issue. The single-electron device is the ultimate low-power consumption device because, as the name implies, it operates on just a single electron. This article describes the operation mechanism of such devices and new fabrication method for single-electron devices developed by NTT Basic Research Laboratories. It also overviews new promising functions of such devices.

Author

Electronic Equipment; Integrated Circuits; Personal Computers; Semiconductor Devices

20000026926 Electrotechnical Lab., Tsukuba, Japan

Development of a High-Precision AC-DC Transfer Standard Using the Fast-Reversed DC Method

Sasaki, Hitoshi, Electrotechnical Lab., Japan; Takahashi, Kunihiko, Electrotechnical Lab., Japan; June 1999; ISSN 0366-9106; 96p; In English; Copyright; Avail: Issuing Activity

The standards of ac quantities, such as ac-voltage or ac-current, are defined by the rms values of the amplitude of alternating waveform. For the realization of the ac-voltage or ac-current standards, the thermal ac-dc transfer standards have been used as the most precise ways in the audio frequency range. In the thermal ac-dc transfer method, the ac quantity and the dc quantity are alternately applied to a thermal converter (TC) which consists of a heater and a thermocouple. Comparing the temperature-rise of the heater by the thermocouple, the ac-voltage is derived by the dc-voltage standard. Since 1974, the ac-dc transfer standard of Japan has been maintained at ETL in the frequency range from 40 Hz to 100 kHz with an uncertainty of 10 ppm. Recent developments of commercially available ac voltmeters and calibrators, however, have made the accuracy insufficient for calibrating those high-precision instruments. Thus a reestablishment of the ac-dc transfer standard of ETL with improved accuracy has become an important subject. This paper summarizes the research on the development of a high-precision ac-dc transfer standard carried out at ETL, in collaboration with Physikalisch-Technische Bundesanstalt of Germany (PTB), National Measurement Laboratory of Australia (CSIRO/NML), and Japan Electric Meters Inspection Corporation (JEMIC). In the first chapter, present status and the historical backgrounds of the ac-dc transfer standards are briefly described. There are three possible approaches to realize the ac-dc transfer standards with precision better than 1 ppm. The first approach is the use of thermal converters. Two types of thermal converters, i.e., the Single-Junction thermal converters (SJTC) and the Multijunction thermal converters(MJTC), are introduced as the ac-dc transfer standards based on thermal methods. The second approach is the direct synthesis of ac waveforms using high-precision D/A converters. A break-through in the precision of the ac-dc transfer standard may be realized using a Josephson D/A converter. The third approach is a combination of the thermal methods and the waveform-synthesis technique. In this approach, precision ac waveforms are used to characterize the thermoelectric property of the thermal converters, This method is called the ”Fast-Reversed DC” (FRDC) method. The development of the method at the ETL is the main theme of this report.

Derived from text

Current Converters (AC to DC); Transferring; Precision; Audio Frequencies; Reversing

20000027517 NASA Marshall Space Flight Center, Huntsville, AL USA

I-V Characteristics of a Ferroelectric Field Effect Transistor

MacLeod, Todd C., NASA Marshall Space Flight Center, USA; Ho, Fat Duen, Alabama Univ., USA; [1999]; 1p; In English; 12th; Integrated Ferroelectrics, 12 Mar. 2000, Aachen, Germany

Contract(s)/Grant(s): RTOP 344-03-01; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

There are many possible uses for ferroelectric field effect transistors.To understand their application, a fundamental knowledge of their basic characteristics must first be found. In this research, the current and voltage characteristics of a field effect transistor are described. The effective gate capacitance and charge are derived from experimental data on an actual FFET. The general equation for a MOSFET is used to derive the internal characteristics of the transistor: This equation is modified slightly to describe the FFET characteristics. Experimental data derived from a Radiant Technologies FFET is used to calculate the internal transistor characteristics using fundamental MOSFET equations. The drain current was measured under several different gate and drain voltages and with different initial polarizations on the ferroelectric material in the transistor. Two different polarization conditions were used. One with the gate ferroelectric material polarized with a +9.0 volt write pulse and one with a -9.0 volt pulse. Author

Electric Potential; Field Effect Transistors; Electric Current; Capacitance-Voltage Characteristics; Polarization (Charge Separation); Ferroelectricity

20000027520 Colorado Univ., Dept. of Electrical and Computer Engineering, Boulder, CO USA

Quasi-Optical Transmit/Receive Front Ends

Popavic, Zoya, Colorado Univ., USA; Mortazawi, A., North Carolina State Univ., USA; IEEE Transactions on Microwave Theory and Techniques; November 1998; ISSN 0018-9480; Volume 46, No. 11, pp. 1964-1976; In English

Contract(s)/Grant(s): DAAH04-96-I-0343; DAAG-55-97-0132

Report No.(s): AD-A369892; ARO-34962.5-EL; Copyright; Avail: Issuing Activity, Microfiche, Hardcopy

Quasi-optical (QO) active circuits have originally received interest for power generation by large-scale power combining of solid-state devices at microwave and millimeter-wave frequencies Here, we present an overview of QO components developed with functionality in mind, with an emphasis on bidirectional amplifier arrays for transmit/receive (T/R) front ends. We discuss possible advantages of the QO architecture for communications and radar The following three QO bidirectional arrays an

presented: 1) a nine-element X-band patch antenna array with different polarizations in T/R modes; 2) a 24-element X-band slot lens xray with switches for the T/R paths; and 3) a 22-element Ka-band patch lens array using monolithic microwave integrated circuits (MMIC's).
Author
Antenna Arrays; Microwave Antennas; Microwave Frequencies; Millimeter Waves; Transmitter Receivers; Optical Communication

20000027620 Mitsubishi Electric Corp., Tokyo, Japan
Space Type 40GHz, 20W TWT Amplifier for Millimeter Wave Personal Communications
Sugawara, S., Mitsubishi Electric Corp., Japan; Ishizu, N., Mitsubishi Electric Corp., Japan; Kubo, H., Nippon Electric Co. Ltd., Japan; Makino, T., Nippon Electric Co. Ltd., Japan; Inoue, A., Nippon Electric Co. Ltd., Japan; Kondo, H., Nippon Electric Co. Ltd., Japan; [2000]; 3p; In English; Copyright; Avail: Issuing Activity

This paper describes 40 GHz, 20 W TWT (Travelling Wave Tube) amplifier for millimeter wave personal communications satellite including the design, performance characteristics. The TWT operates in the frequency range from 43 to 45GHz, and output power of 25W overall efficiency of 26% have been achieved.
Author
Power Amplifiers; Millimeter Waves; Communication Satellites; Design Analysis; Performance Prediction; Traveling Wave Tubes

20000027623 Mitsubishi Electric Corp., Tokyo, Japan
A Solid State Power Amplifier Design and Performance for Mobile Communications Satellites
Sekine, Kenji, Mitsubishi Electric Corp., Japan; Dooi, Yoshikazu, Mitsubishi Electric Corp., Japan; Iso, Akio, Mitsubishi Electric Corp., Japan; [1989]; 6p; In English; Copyright; Avail: Issuing Activity

In mobile communications satellites, a large antenna and high-power output transponders are required so that a large number of small and handy earth terminals can be applied for commercial use. The transmitting power amplifier of communications transponders needed to amplify the multi-carrier signals must be high powered and have excellent linearity. In order to achieve this, a high-efficiency linear solid state power amplifier is developed by using harmonics control technique. The design of the harmonics controlled amplifiers (HCA), is confirmed by URF and S band SSPAs (Solid State Power Amplifiers). The UHF band SSPA utilizes Si-MOSFET (Silicon Metal-Oxide Semiconductor Field Effect Transistor). An output power of 54 W, a power added efficiency of 47% at 1 dB gain compression, and a 2-tone 3rd order intermodulation distortion of 20 dB at 3 dB output back-off from saturation is realized at 835 MHz. The S band SSPA utilizes GaAs FET. An output power of 81 W, a power added efficiency of 40% at l dB gain compression and a 2-tone 3rd order intermodulation distortion of 23 dB at 3 dB output back-off from saturation is realized at 2.5 GHz.
Author
Mobile Communication Systems; Power Amplifiers; Amplifier Design; Solid State Devices; Performance Prediction

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FLUID MECHANICS AND THERMODYNAMICS

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

20000025297 Institute for Computer Applications in Science and Engineering, Hampton, VA USA
Textbook Multigrid Efficiency for the Incompressible Navier-Stokes Equations: High Reynolds Number Wakes and Boundary Layers
Thomas, James L.; Diskin, Boris; Brandt, Achi; Dec. 1999; 23p; In English
Contract(s)/Grant(s): NAS1-97046
Report No.(s): AD-A372313; ICASE-99-51; NASA/CR-1999-209831; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Textbook multigrid efficiencies for high Reynolds number simulations based on the incompressible Navier Stokes equations are attained for a model problem of flow past a finite flat plate. Elements of the Full Approximation Scheme multigrid algorithm, including distributed relaxation, defect correction, and boundary treatment, are presented for the three main physical aspects

encountered: entering flow, wake flow, and boundary layer flow. Textbook efficiencies, i.e., reduction of algebraic errors below discretization errors in one full multigrid cycle, are attained for second order accurate simulations at a laminar Reynolds number of 10,000.
DTIC
Boundary Layer Flow; Flat Plates; High Reynolds Number; Incompressible Flow; Navier-Stokes Equation; Computational Fluid Dynamics

20000025342 Massachusetts Inst. of Tech., Dept. of Ocean Engineering, Cambridge, MA USA
Holographic Particle Image Velocimetry: Computational Simulation and Reconstruction
Earls, Craig P.; Jun. 1999; 80p; In English
Report No.(s): AD-A372219; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Holographic Particle Image Velocimetry (HPIV) is a novel technique for measuring the complete fluid flow around a body. Advances in computing power make this technique practicable for the first time. Currently popular techniques for experimentally determining fluid flow around a test body rely on measuring the flow at a single point and moving the sample point during the experiment. This implicitly time averages the data. HPIV can measure the flow field in a volume nearly instantaneously by sequentially ”hole graphing” the seeded flow field. Until recently the only practical method of processing the HPIV data was to physically reconstruct the optical image from the hologram and scan through the resulting volume using microscope optics. This is a very slow process. Recent advances in computing power make it possible to directly analyze the digitized holograph (digitized using a high resolution scanner) This reduces the post-processing time from several hours to less than 1-hour with much less expensive equipment. The primary contribution of this thesis is an advanced multi-platform graphical user interface hologram synthesizer for use in calibrating digital HPIV reconstruction algorithms.
DTIC
Holography; Particle Image Velocimetry; Imaging Techniques; Flow Distribution; Fluid Flow; Simulation

20000025349 Massachusetts Inst. of Tech., Dept. of Ocean Engineering, Cambridge, MA USA
Prediction of Propulsor-Induced Maneuvering Forces Using a Coupled Viscous/Potential-Flow Method for Integrated Propulsors
Warren, Christopher L.; Jun. 1999; 144p; In English
Report No.(s): AD-A372160; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This thesis develops a method to analyze the maneuvering forces on surfaced and underwater vehicles with complex propulsors. The analysis method is developed for general propellers yet has unique applicability to model highly contracting stern flows associated with integrated propulsors. Integrated propulsors exhibit strong coupling of the various blade rows and duct, if present, to the vehicle stern. The method developed herein provides a robust means to analyze propulsor induced maneuvering forces including those arising from wake adapted, multi-stage, ducted propulsors. The heart of the maneuvering force prediction is a three-dimensional, unsteady lifting surface method developed as the first part of this thesis. The new method is designated PUF-14 for Propeller Unsteady Forces. The lifting surface method uses many advanced techniques. One significant advance is the use of a wake adapted lattice to model the flow through the propulsor. In related research, a 2-D Kutta condition has been augmented using Lagrangian interpolation to dramatically reduce the required computational time to model a 2-D gust. The second thrust of this thesis couples the unsteady lifting surface method with a three-dimensional, time-average Reynolds Averaged Navier Stokes flow solver. Rotating a propeller through a spatially varying flow field causes temporally varying forces on the propeller. From the converged coupled solution, the maneuvering and blade rate forces can be estimated. This thesis explores the relationship of time varying and time average forces in the flow solver and potential flow domains. Similarly, it explores the relationship of the effective inflow in the two domains. Finally, this thesis details the synergistic means to correctly couple the potential flow method to a viscous solver. Verification and validation of the method have been done on a variety of geometries and vehicles. Preliminary results show good correlation with experiment.
DTIC
Flow Distribution; Propellers; Underwater Vehicles; Underwater Propulsion

20000025387 NASA Glenn Research Center, Cleveland, OH USA
Ninth Thermal and Fluids Analysis Workshop Proceedings
Sakowski, Barbara, Compiler, NASA Glenn Research Center, USA; Ninth Thermal and Fluids Analysis Workshop Proceedings; November 1999; 276p; In English; 9th; Ninth Thermal and Fluids Analysis Workshop Proceedings, 31 Aug. - 4 Sep. 1998, Cleveland, OH, USA; See also 20000025388 through 20000025406
Contract(s)/Grant(s): RTOP 940-30-08-21

Report No.(s): NASA/CP-1999-208695; E-11411; NAS 1.55:208695; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

The Ninth Thermal and Fluids Analysis Workshop (TFAWS 98) was held at the Ohio Aerospace Institute in Cleveland, Ohio from August 31 to September 4, 1998. The theme for the hands-on training workshop and conference was "Integrating Computational Fluid Dynamics and Heat Transfer into the Design Process." Highlights of the workshop (in addition to the papers published herein) included an address by the NASA Chief Engineer, Dr. Daniel Mulville; a CFD short course by Dr. John D. Anderson of the University of Maryland; and a short course by Dr. Robert Cochran of Sandia National Laboratories. In addition, lectures and hands-on training were offered in the use of several cutting-edge engineering design and analysis-oriented CFD and Heat Transfer tools. The workshop resulted in international participation of over 125 persons representing aerospace and automotive industries, academia, software providers, government agencies, and private corporations. The papers published herein address issues and solutions related to the integration of computational fluid dynamics and heat transfer into the engineering design process. Although the primary focus is aerospace, the topics and ideas presented are applicable to many other areas where these and other disciplines are interdependent.

Author

Computational Fluid Dynamics; Conferences; Thermal Analysis; Education; Applications Programs (Computers); Mechanical Engineering

20000025388 ICEM CFD Engineering, Berkeley, CA USA

Efficient Integration of CFD into Product Design

Akdag, Vedat, ICEM CFD Engineering, USA; Magnuson, Al, ICEM CFD Engineering, USA; Wulf, Armin, ICEM CFD Engineering, USA; Ninth Thermal and Fluids Analysis Workshop Proceedings; November 1999, pp. 27-36; In English; See also 20000025387; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

In recent years, CFD has taken rapid strides through the development and application of unified. robust and efficient methods, and CFD grid generation codes have shown major improvements mainly due to stronger links to the underlying CAD geometry. However. many grid generation systems have focused on inadequate interfaces (e.g. IGES) for transferring CAD (Computer Aided Design) geometry into the grid generation environment. These interfaces have limited the utilization of advanced CAD features like parametric geometry definition by grid generation systems - as soon as the geometry is translated for grid generation, the associativity between the parametric geometry and the grid is no longer maintained. ICEM (Integrated Computer Aided Engineering and Manufacturing) CFD's direct CAD interfaces maintain the associations between the CAD model and the grid generation process. Using, ICEM CFD unstructured grids can be directly remeshed on the modified geometry. For structured grids, once the initial topology is defined, changes in the CAD model cause the ICEM CFD grid generation system to produce corresponding changes in the computational grid. The capability of ICEM CFD operating in an integrated geometry and grid generation environment is demonstrated.

Author

Computational Fluid Dynamics; Computer Aided Design; Grid Generation (Mathematics); Applications Programs (Computers); Aircraft Design

20000025394 Academy of Sciences (USSR), Inst. for Problems in Mechanics, Moscow, USSR

Concept of the Local Thermo-Chemical Simulation for Re-entry Problem: Validation and Applications

Kolesnikov, Anatoliy F., Academy of Sciences (USSR), USSR; Ninth Thermal and Fluids Analysis Workshop Proceedings; November 1999, pp. 107-116; In English; See also 20000025387

Contract(s)/Grant(s): INTAS-95-1329; ISTC Proj. 036; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The concept of the local thermo-chemical simulation (LTS) of the high-enthalpy flow action on a vehicle stagnation point formulated in references 1 and 2 is based on the requirement to locally provide in a ground test the same boundary layer on the model as at the re-entry conditions. The validation of this concept is carried out through the comparative analysis of computed heat transfer rates and profiles of gas temperature and atoms fractions within boundary layers near the model in the subsonic high-enthalpy air flow and near the blunt body in the hypersonic air flow whose parameters are extrapolated from the inductively heated plasma experiment. It is established that the LTS provides a very good accuracy if air temperatures at the outer edges of both boundary layers near a model and a body are close to equilibrium value or surface catalycity is high enough. An example of the LTS concept application is shown through a prediction of the plasmatron subsonic test parameters for the simulation of heat transfer to the Mars Pathfinder aeroshell at the peak-heating conditions in the Martian atmosphere. The computed stagnation point

heat flux range for the model in the subsonic dissociated carbon dioxide flow in the whole range of surface catalycity is found in good agreement with the viscous-shock layer analysis carried out for the aeroshell without the surface ablation.
Author
Reentry; Computerized Simulation; Stagnation Point; Enthalpy; Thermochemistry

20000025398 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Integrated Modeling Tools for Thermal Analysis and Applications
Milman, Mark H., Jet Propulsion Lab., California Inst. of Tech., USA; Needels, Laura, Jet Propulsion Lab., California Inst. of Tech., USA; Papalexandris, Miltiadis, Jet Propulsion Lab., California Inst. of Tech., USA; Ninth Thermal and Fluids Analysis Workshop Proceedings; November 1999, pp. 167-179; In English; See also 20000025387; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Integrated modeling of spacecraft systems is a rapidly evolving area in which multidisciplinary models are developed to design and analyze spacecraft configurations. These models are especially important in the early design stages where rapid trades between subsystems can substantially impact design decisions. Integrated modeling is one of the cornerstones of two of NASA's planned missions in the Origins Program -- the Next Generation Space Telescope (NGST) and the Space Interferometry Mission (SIM). Common modeling tools for control design and opto-mechanical analysis have recently emerged and are becoming increasingly widely used. A discipline that has been somewhat less integrated, but is nevertheless of critical concern for high precision optical instruments, is thermal analysis and design. A major factor contributing to this mild estrangement is that the modeling philosophies and objectives for structural and thermal systems typically do not coincide. Consequently the tools that are used in these discplines suffer a degree of incompatibility, each having developed along their own evolutionary path. Although standard thermal tools have worked relatively well in the past. integration with other disciplines requires revisiting modeling assumptions and solution methods. Over the past several years we have been developing a MATLAB based integrated modeling tool called IMOS (Integrated Modeling of Optical Systems) which integrates many aspects of structural, optical, control and dynamical analysis disciplines. Recent efforts have included developing a thermal modeling and analysis capability, which is the subject of this article. Currently, the IMOS thermal suite contains steady state and transient heat equation solvers, and the ability to set up the linear conduction network from an IMOS finite element model. The IMOS code generates linear conduction elements associated with plates and beams/rods of the thermal network directly from the finite element structural model. Conductances for temperature varying materials are accommodated. This capability both streamlines the process of developing the thermal model from the finite element model, and also makes the structural and thermal models compatible in the sense that each structural node is associated with a thermal node. This is particularly useful when the purpose of the analysis is to predict structural deformations due to thermal loads. The steady state solver uses a restricted step size Newton method, and the transient solver is an adaptive step size implicit method applicable to general differential algebraic systems. Temperature dependent conductances and capacitances are accommodated by the solvers. In addition to discussing the modeling and solution methods. applications where the thermal modeling is "in the loop" with sensitivity analysis, optimization and optical performance drawn from our experiences with the Space Interferometry Mission (SIM), and the Next Generation Space Telescope (NGST) are presented.
Author
Thermal Analysis; Mathematical Models; Systems Integration; Control Systems Design; Spacecraft Configurations

20000025402 Hughes Space and Communications Group, Los Angeles, CA USA
Modeling of a Deployable Radiator/Loop Heat Pipe System
Parker, Michelle L., Hughes Space and Communications Group, USA; Drolen, Bruce L., Hughes Space and Communications Group, USA; Ayyaswamy, P. S., Pennsylvania Univ., USA; Ninth Thermal and Fluids Analysis Workshop Proceedings; November 1999, pp. 233-238; In English; See also 20000025387; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The commercial satellite industry is booming, and the demand for increased-capability spacecraft has presented thermal engineers with an interesting challenge. Higher and higher power levels create a need for more efficient heat rejection systems. The size of future satellites, however, does not provide for sufficient "fixed" radiator area to remove the heat generated by the increasing number of high-power units. A way had to be found to increase the heat rejection area, and to efficiently transport heat to this additional area. Over the past few years, Hughes has developed a system which utilizes deployable radiators to increase the heat rejection area, and Loop Heat Pipes (LHPS) to transport heat from inside the spacecraft to the deployable radiators whence it is rejected to space. This combination has made it possible for Hughes to greatly increase transponder capacity on its commercial satellites. The ability to accurately model this system has therefore become critical to the design and integration of high powered spacecraft. This paper presents the modelint, methodology, and the correlation of the model to ground tests performed at Hughes. In the modeling, SINDA/FLUINT (Systems Improved Numerical Differencing Analyzer/Fluid Integrator) has been used to model both the thermal and fluid aspects of the system. One of the keys to modelino this system is an understanding of the Russian

developed Loop Heat Pipe (LHP). A brief description of the characteristics of the LHP and the approach taken in modeling it are also included in this paper. Accurate modeling of the LHP has been verified by correlation with ground test data. A ground test was performed with a simulated deployable radiator having two LHPs creating an upper zone and a lower zone. Results have been correlated and are presented for an upper LHP input power of 828 W. The lower zone provides the boundary temperature. The effects from parasitic heat leaks from the lower zone are apparent in the test results and are reproduced by the SINDA/FLUINT model. It may be noted that this is the first time that interactions between two LHPs mounted on a radiator have been systematically analyzed. The ground test has proved that these interactions are important, and the correlated mode'I now gives us the ability to predict the effects of parasitic heat leaks. This enhanced modeling capability enables a better understandinc, of the deployable radiator/LHP system, and will aid in the design of more efficient systems in the future.
Author
Mathematical Models; Heat Pipes; Commercial Spacecraft; Spacecraft Radiators; Thermal Analysis

20000025433 National Inst. of Standards and Technology, Building and Fire Research Lab., Gaithersburg, MD USA
Comparison of Algorithms of Calculate Plume Centerline Temperature and Ceiling Jet Temperature with Experiments
Davis, W. D.; Jan. 2000; 44p; In English
Report No.(s): PB2000-101595; NISTIR-6448; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The predictive capability of two algorithms designed to calculate plume centerline temperature and maximum ceiling jet temperature in the presence of a hot upper layer are compared with measurements from a series of experiments. In addition, comparisons are made using the ceiling jet algorithm in CFAST (version 3.1), the unconfined plume algorithm of Heskestad, and the unconfined ceiling jet algorithm of Alpert. The experiments included ceiling heights of 0.58 m to 22 m and heat release rates (HRR) of 0.62 kW to 33 MW. It was shown that the unconfined ceiling algorithms underpredicted the temperatures while the ceiling jet algorithm in CFAST overpredicted the temperature in the presence of a hot layer. With the combined uncertainty of the measurement and the calculation roughly equal to +/- 20%, the algorithms of both Evans and Davis et. al. consistently provided predictions either close to or within this uncertainty interval for all fire sizes and ceiling heights.
NTIS
Algorithms; Computerized Simulation; Computer Programming; Computer Aided Design; Three Dimensional Models; Plumes

20000025487 Sverdrup Technology, Inc., Huntsville, AL USA
An Unsteady Long Bearing Squeeze Film Damper Model, Part 2, Statically Eccentric Operation
Schallhorn, P. A., Sverdrup Technology, Inc., USA; Elrod, D. A., Sverdrup Technology, Inc., USA; Goggin, D. G., Sverdrup Technology, Inc., USA; Majumdar, A. K., Sverdrup Technology, Inc., USA; [2000]; 27p; In English; 38th; 38th Aerospace Sciences Meeting, 10-13 Jan. 2000, Reno, NV, USA
Contract(s)/Grant(s): NAS8-40386; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper, the second of a two-part series, presents results of an unsteady rotordynamic analysis of a long-bearing squeeze film damper executing orbits about an off center position using a fluid circuit approach. A series of nodes and branches represent the geometry of the flow circuit. The mass and momentum conservation equations are solved to predict the pressure distribution in the squeeze film. The motion of the bearing is simulated by the variation of geometry within the flow path. This effort represents the first modeling approach which allows for an arbitrary orbit size about an arbitrary position.
Author
Momentum Theory; Rotor Dynamics; Squeeze Films; Finite Volume Method; Rotor Aerodynamics; Vibration Damping; Vibration Isolators

20000025499 NASA Langley Research Center, Hampton, VA USA
Control and Augmentation of Passive Porosity through Transpiration Control
Banks, Daniel W., Inventor, NASA Langley Research Center, USA; Wood, Richard M., Inventor, NASA Langley Research Center, USA; Bauer, Steven X. S., Inventor, NASA Langley Research Center, USA; May 11, 1999; In English
Patent Info.: Filed 22 May 1992; NASA-Case-LAR-14682; US-Patent-5,901,929; US-Patent-Appl-SN-887002; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

A device for controlling pressure loading of a member caused by a fluid moving past the member or the member moving through a fluid. The device consists of a porous skin mounted over the solid surface of the member and separated from the solid surface by a plenum. Fluid from an area exerting high pressure on the member may enter the plenum through the porous surface

and exit into an area exerting a lower pressure on the member, thus controlling pressure loading of the member. A transpirational control device controls the conditions within the plenum thus controlling the side force and yaw moment on the forebody.
Official Gazette of the U.S. Patent and Trademark Office
Augmentation; Porosity; Transpiration; Aircraft Control; Skin (Structural Member)

20000025549 Institute for Computer Applications in Science and Engineering, Hampton, VA USA
Large-Scale Parallel Viscous Flow Computations Using an Unstructured Multigrid Algorithm
Mavriplis, Dimitri J.; Nov. 1999; 16p; In English
Contract(s)/Grant(s): NAS1-97046
Report No.(s): AD-A371861; ICASE-99-44; NASA-CR-1999-209724; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The development and testing of a parallel unstructured agglomeration multigrid algorithm for steady-state aerodynamic flows is discussed. The agglomeration multigrid strategy uses a graph algorithm to construct the coarse multigrid levels from the given fine grid, similar to an algebraic multigrid approach, but operates directly on the non-linear system using the FAS approach. The scalability and convergence rate of the multigrid algorithm are examined on the SGI Origin 2000 and the Cray T3E. An argument is given which indicates that the asymptotic scalability of the multigrid algorithm should be similar to that of its underlying single grid smoothing scheme. For medium size problems involving several million grid points, near perfect scalability is obtained for the single grid algorithm, while only a slight drop-off in parallel efficiency is observed for the multigrid V- and W-cycles, using up to 128 processors on the SGI Origin 2000, and up to 512 processors on the Cray T3E. For a large problem using 25 million grid points, good scalability is observed for the multigrid algorithm using up to 1450 processors on a Cray T3E, even when the coarsest grid level contains fewer points than the total number of processors.
DTIC
Computational Fluid Dynamics; Parallel Flow; Viscous Flow

20000025777 National Aerospace Lab., Tokyo Japan
Heat Flux Measurements by a Slug Calorimeter in an Arc Heated Flow
Watanabe, Y.; Matsuzaki, T.; Ishida, K.; Miho, K.; Fukui, T.; Jun. 1999; 16p; In Japanese; Portions of this document are not fully legible
Report No.(s): PB2000-102567; NAL-TR-1388; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper shows the application of a slug type calorimeter to the heat flux measurements of an arc-heated flow, and evaluates the effect of slug surface coatings with differing catalytic efficiency on measured heat flux. Metallic coatings are more catalytic and result in higher heat flux values than coating containing silica. These results are in accordance with the known order of catalytic effectiveness. Measured heat flux values agree in magnitude and lie within a factor of 1.8 of the values obtained by Gardon type calorimeters. Presumed sources of the difference are difference in sensing areas, ambiguity of surface characteristics, and flow field nonuniformity.
NTIS
Heat Flux; Heat Measurement; Calorimeters; Flux Quantization; Arc Heating

20000026837 Air Force Office of Scientific Research, Bolling AFB, Washington, DC USA
Contractor's Meeting in Turbulence and Rotating Flows
Beutner, Thomas, Air Force Office of Scientific Research, Bolling AFB, USA; Aug. 18, 1999; 293p; In English
Contract(s)/Grant(s): F49620-97-1-0519
Report No.(s): AD-A372510; AFRL-SR-BL-TR-99-0301; No Copyright; Avail: CASI; A03, Microfiche; A13, Hardcopy

This report documents annual progress reports and final reports from grants and contracts in the Air Force Office of Scientific Research program in Turbulence and Rotating Flows. Major topical areas covered by these reports include turbulence measurements and modeling, flow control theory and demonstrations, turbomachinery flow fields, heat transfer in turbomachinery, reduced order modeling of complex flows, and microelectromechanical systems (MEMS) sensors and actuators.
DTIC
Turbulent Flow; Rotating Fluids; Microelectromechanical Systems; Turbomachinery; Complex Systems

20000026846 New South Wales Univ., Water Research Lab., Kensington, Australia
A Laboratory Study of Low-Frequency Wave Dissipation Due to an Opposing Wind ***Final Report***
Peirson, W. L., New South Wales Univ., Australia; Carley, J. T., New South Wales Univ., Australia; Dec. 17, 1999; 17p; In English
Contract(s)/Grant(s): N68171-99-M-5337

Report No.(s): AD-A372585; WRL-RR-203; R/D-8641-EN-01; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Estimates of wave dissipation due to an opposing wind based on correlating pressures above the waves with the surface slope were first undertaken by Snyder et al., 1981. These indicated that decay rates due to an opposing wind were roughly an order of magnitude smaller than wind generated wave growth rates. Other field measurements (Hasselman and Bosenberg, 1991) and laboratory measurements (Young and Sobey, 1985) using this technique have also indicated that dissipation rates are very small. However, wave dissipation rates can also be derived from measurements of the decline in surface variance with fetch. The measurement of surface variance has been used by Misuyasu and Honda, 1982 to estimate the growth rates of laboratory paddle waves due to a concurrent wind. Such measurements are more direct and have consistently yielded higher growth rates than pressure correlation techniques in the air (Bole and Hsu, 1969). Recent theoretical estimates (Mastenbroek, 1996 and Cohen, 1997) using second order turbulence closure models anticipate that dissipation rates should be substantially higher than indicated by previous studies. In this report, we, present the results of recent laboratory experiments that provide alternative estimates of wave dissipation due to an opposing wind obtained from measurements of the surface wave field. These show that the reported levels of dissipation obtained by the technique of measurements in the air are far too low. Furthermore, they show, that theoretical estimates also underestimate the dissipation rates by a factor of at least 3. Further work is required to improve the accuracy of the measurements and to extend the range of wind speeds and wave frequencies investigated.

DTIC

Air Water Interactions; Surface Waves; Turbulent Flow; Water Waves; Wind Effects; Wind Pressure

20000027524 Iowa Univ., Dept. of Mechanical Engineering, Iowa City, IA USA

Three-Dimensional Blade-Vortex Interaction in the Strong Vortex Regime

Krishnamoorthy, S., Iowa Univ., USA; Marshall, J. S., Iowa Univ., USA; Physics of Fluids; November 1998; ISSN 1070-6631; Volume 10, No. 11, pp. 2828; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

A study of three-dimensional interaction between a blade and an initially columnar vortex was performed using flow visualization experiments and computer simulations for problems where the blade is translated normal to and impacts upon the vortex core. The reported research focuses on cases where the vortex is sufficiently strong and the blade boundary layer separates before the blade penetrates into the vortex core. The study examines the topology and evolution of the separated secondary vorticity from tile blade and its interaction with the primary vortex. In particular, it is observed that the separated vorticity from blade has the form of a series of vortex loops that wrap around the outer surface of the primary vortex core and spread both upstream and downstream along the vortex axis. Both the initial formation of these vortex loops and their eventual interaction with the primary vortex arc investigated. Computations based on a series of idealized models of the secondary vorticity are performed in order to examine the primary vortex response to wrapped vortex loops.

Author

Blade-Vortex Interaction; Three Dimensional Motion; Vortices

20000027526 NASA Marshall Space Flight Center, Huntsville, AL USA

The Effect of a Rotating Magnetic Field on Rayleigh-Benard Convection

Volz, Martin P., NASA Marshall Space Flight Center, USA; Mazuruk, K., NASA Marshall Space Flight Center, USA; [1999]; 1p; In English, 21 Mar. 2000, Minneapolis, MN, USA; Sponsored by American Physical Society, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

A destabilizing vertical temperature gradient and a rotating magnetic field have been applied to a cylindrical column of liquid gallium. The convective flows which arise as a function of these driving parameters are identified. For small magnetic field strengths, a region of stationary flow is observed. This region is bounded by critical values of the Rayleigh and Hartmann numbers. As the rotating magnetic field is increased, the critical Rayleigh number can increase by more than a factor of 10. The rotating magnetic field itself induces an instability at a critical value of the Hartmann number independent of the Rayleigh number. The nature of the bifurcations (whether subcritical or supercritical) and the convective flows occurring at the critical Rayleigh numbers are dependent upon the Hartmann number. In the stationary flow region, the rotating magnetic field can induce fluid motion with velocities on the order of cm/s. Thus, a rotating magnetic field can be used to achieve the benefits of forced convection during crystal growth processes without triggering deleterious instabilities.

Author

Hartmann Number; Magnetic Effects; Magnetic Fields; Rayleigh Number; Rayleigh-Benard Convection; Rotation

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.

20000025307 NASA Glenn Research Center, Cleveland, OH USA
Rare Earth Optical Temperature Sensor
Chubb, Donald L., NASA Glenn Research Center, USA; Wolford, David S., NASA Glenn Research Center, USA; January 2000; 24p; In English
Contract(s)/Grant(s): RTOP 632-1A-1A
Report No.(s): NASA/TM-2000-209657; NAS 1.15:209657; E-11970; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A new optical temperature sensor suitable for high temperatures (greater than 1700 K) and harsh environments is introduced. The key component of the sensor is the rare earth material contained at the end of a sensor that is in contact with the sample being measured. The measured narrow wavelength band emission from the rare earth is used to deduce the sample temperature. A simplified relation between the temperature and measured radiation was verified experimentally. The upper temperature limit of the sensor is determined by material limits to be approximately 2000 C. The lower limit, determined by the minimum detectable radiation, is found to be approximately 700 K. At high temperatures 1 K resolution is predicted. Also, millisecond response times are calculated.
Author
Rare Earth Elements; High Temperature; Optical Measuring Instruments; Sensors; Mathematical Models

20000025448 Michigan Technological Univ., Houghton, MI USA
Scintillation Control for Adaptive Optical Sensors ***Final Report, 23 Feb. 1998 - 31 Jul. 1999***
Roggemann, Michael C.; Sep. 21, 1999; 59p; In English
Contract(s)/Grant(s): F49620-98-1-0295
Report No.(s): AD-A372491; AFRL-SR-BL-TR-00-0017; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

Michigan Technological University (MTU) has been investigating strategies for overcoming the effects of scintillation on adaptive optical imaging and laser beam projection systems which must operate in the presence of extended path turbulence. The approach origin ally proposed under this contract involved using two deformable mirrors to fully conjugate the received or transmitted beam. Our investigations into this concept have shown that implementation details associated with the use of real adaptive optical hardware will likely limit the effectiveness of the two deformable mirror technique. As a consequence, an alternative approach using one deformable mirror was developed, and its performance was investigated. This technique exploits the fact that, under strong scintillation conditions, information about the phase of the beacon field is incorporated in the intensity of the beacon field. Hence, deformable mirror commands which are consistent with all of the intensity measurements available to an adaptive optical system are processed using a new nonlinear optimization based algorithm. Our studies of the performance of this technique have shown that under conditions of saturated scintillation this new approach significantly outperforms the standard centroid based processing of the Hartmann sensor measurements. An experiment conducted at MTU has demonstrated the ability to predict a laser intensity pattern in a distant target plane using Hartmann sensor measurements of the field reflected from a deformable mirror. One accepted journal article, and one submitted journal article have resulted from this work, along with three conference papers. In addition, this work forms the basis of a program which is now being conducted with the Airborne Laser Technology Division.
DTIC
Scintillation; Adaptive Optics; Optical Measuring Instruments; Imaging Techniques; Images; Adaptive Control

20000025506 NASA Lewis Research Center, Cleveland, OH USA
Stereo Imaging Velocimetry
McDowell, Mark, Inventor, NASA Lewis Research Center, USA; Glasgow, Thomas K., Inventor, NASA Lewis Research Center, USA; May 18, 1999; In English
Patent Info.: Filed 15 Dec. 1997; NASA-Case-LEW-16475-1; US-Patent-5,905,568; US-Patent-Appl-SN-990265; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

A system and a method for measuring three-dimensional velocities at a plurality of points in a fluid employing at least two cameras positioned approximately perpendicular to one another. The cameras are calibrated to accurately represent image

coordinates in world coordinate system. The two-dimensional views of the cameras are recorded for image processing and centroid coordinate determination. Any overlapping particle clusters are decomposed into constituent centroids. The tracer particles are tracked on a two-dimensional basis and then stereo matched to obtain three-dimensional locations of the particles as a function of time so that velocities can be measured therefrom The stereo imaging velocimetry technique of the present invention provides a full-field. quantitative, three-dimensional map of any optically transparent fluid which is seeded with tracer particles.
Official Gazette of the U.S. Patent and Trademark Office
Cameras; Image Processing; Imaging Techniques; Velocity Measurement; Stereoscopy

20000025540 Southwest Research Inst., Instrumentation and Space Research Div., San Antonio, TX USA
Particle Detectors and Data Analysis for Cusp Transient Features Campaign ***Final Report, Period ending 30 Nov. 1999***
Sharber, James R., Southwest Research Inst., USA; Nov. 30, 1999; 17p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG5-5084; SwRI Proj. 15-8087; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

On December 3, 1997, a rocket payload (36.152) was launched from N(sub y) Alesund into the dark cusp at 0906:00 U (1206:00 LT) during an interval of southward B(sub z) and positive B(sub y). Launch occurred during a time interval of northeastward moving auroral forms observed between 0845 and 0945 UT by ground-based meridian scanning photometers. Ground photometric measurements during the flight show that the payload passed over the poleward portion of the most intense 6300 A emissions of the dayside cusp/cleft region. Electrons of energy up to a few hundred eV were detected immediately upon instrument turn-on at an altitude of 205 km and throughout the flight until the payload reached an altitude of -197 km on the downleg. Electron spectra were either quasithermal with peak energies -100 eV or showed evidence of acceleration along the magnetic field line by potentials of 100-200 V. Precipitating ions were observed throughout much of the flight. Their spectra were broadly peaked in energy with the peak energy decreasing from -500 eV to -250 eV as the payload flew approximately westward over the dayside precipitation region. Structure (spatial or temporal intensity variation) was observed between T + 180 s and T + -400 s. At the rocket altitudes (is less than 450 km) the ions were observed to be precipitating. During the flight, the DMSP F-13 satellite passed through the all-sky imager field-of-view just poleward of the brightest dayside emissions enabling the identification of plasma sheet and boundary layer regions along the orbit. We thus conclude that particle fluxes detected by the rocket flight were either cusp plasma or boundary layer/mantle plasma just poleward of the dayside cusp/cleft. A paper describing the fields and plasmas observed during the flight is now being prepared for publication.
Author
Radiation Counters; Ions; Data Processing; Polar Cusps; Interplanetary Space; Space Plasmas; Rocket Flight; Payloads

20000025758 Rutherford Appleton Lab., Chilton, UK
Selection, Rejection and Optimization of Pyrolytic Graphite (PG) Crystal Analyzers for Use on the New IRIS Graphite Analyzer Bank
Marshall, P. J., Rutherford Appleton Lab., UK; Sivia, D. S., Rutherford Appleton Lab., UK; Adams, M. A., Rutherford Appleton Lab., UK; Telling, M. T. F., Rutherford Appleton Lab., UK; Jan. 27, 2000; ISSN 1358-6254; 34p; In English
Report No.(s): RAL-TR-2000-003; Copyright; Avail: Issuing Activity

This report discusses design problems incurred by equipping the IRIS high-resolution inelastic spectrometer at the ISIS pulsed neutron source, UK with a new 4212 piece pyrolytic graphite crystal analyser array. of the 4212 graphite pieces required, approximately 2500 will be newly purchased PG crystals with the remainder comprising of the currently installed graphite analysers. The quality of the new analyser pieces, with respect to manufacturing specifications, is assessed, as is the optimum arrangement of new PG pieces amongst old to circumvent degradation of the spectrometer's current angular resolution. Techniques employed to achieve these criteria include accurate caliper measurements, FORTRAN programming and statistical analysis.
Author
Optimization; Design Analysis; Pyrolytic Graphite; Crystals; High Resolution; Infrared Spectrometers; ISIS Satellites; Neutron Sources

20000026316 NASA Johnson Space Center, Houston, TX USA
Evaluation of the Hydrodynamic Focusing Bioreactor (HDFB) and the Centrifugal Absorption Cartridge System (CACS) Performance Under Micro G
Gonda, Steve, NASA Johnson Space Center, USA; Lee, Wenshan, Wyle Labs., Inc., USA; Flechsig, Steve, Wyle Labs., Inc., USA; KC-135 and Other Microgravity Simulations; August 1999, pp. 62-64; In English; See also 20000026303; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The Hydrodynamic Focusing Bioreactor (HDFB) technology is designed to provide a flow field with nearly uniform shear force throughout the vessel, which can provide the desired low shear force spatial environment to suspend three-dimensional cell aggregates while providing optimum mass transfer. The reactor vessel consists of a dome-shaped cell culture vessel, a viscous spinner, an access port, and a rotating base. The domed vessel face has a radius of R(o). and rotates at 0mega(o) rpm, while the internal viscous spinner has a radius of R(i) and rotates at 0mega(i) rpm. The culture vessel is completely filled with cell culture medium into which three-dimensional cellular structures are introduced. The HDFB domed vessel and spinner were driven by two independent step motors,
Author
Bioreactors; Centrifugal Force; Flow Distribution; Performance Tests; Microgravity

20000026333 NASA Johnson Space Center, Houston, TX USA
Magnetic Field Apparatus (MFA) Hardware Test
Anderson, Ken, Bionetics Corp., USA; Boody, April, Bionetics Corp., USA; Reed, Dave, Bionetics Corp., USA; Wang, Chung, Bionetics Corp., USA; Stuckey, Bob, NASA Johnson Space Center, USA; Cox, Dave, NASA Kennedy Space Center, USA; KC-135 and Other Microgravity Simulations; August 1999, pp. 142-146; In English; See also 20000026303; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The objectives of this study are threefold: (1) Provide insight into water delivery in microgravity and determine optimal germination paper wetting for subsequent seed germination in microgravity; (2) Observe the behavior of water exposed to a strong localized magnetic field in microgravity; and (3) Simulate the flow of fixative (using water) through the hardware. The Magnetic Field Apparatus (MFA) is a new piece of hardware slated to fly on the Space Shuttle in early 2001. MFA is designed to expose plant tissue to magnets in a microgravity environment, deliver water to the plant tissue, record photographic images of plant tissue, and deliver fixative to the plant tissue.
CASI
Germination; Magnetic Fields; Microgravity; Seeds; Water; Wetting; Plants (Botany)

20000026334 California Univ., Berkeley, CA USA
Ergonomic Evaluation of the Life Sciences Glovebox (LSG)
Murthy, Gita, California Univ., USA; Rempel, David, California Univ., USA; Brewer, Richard, California Univ., USA; Tal, Ron, California Univ., USA; Fujino, Hiroshi, Ishikawajima-Harima Heavy Industries Co. Ltd., Japan; Sugimura, Fumitaka, Ishikawajima-Harima Heavy Industries Co. Ltd., Japan; Ueno, Toshiaki, National Space Development Agency, Japan; Kawazoe, Kenichi, National Space Development Agency, Japan; KC-135 and Other Microgravity Simulations; August 1999, pp. 147-150; In English; See also 20000026303; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The University of California was contracted by Ishikawajima-Harima Heavy Industries, Inc. (EM) in collaboration with NASDA, to perform an ergonomics evaluation of the Life Sciences Glovebox (LSG) design to accommodate the 95%ile Caucasian male and the 5%ile Japanese female crew members. In Phase 1 of this investigation, we evaluated the LSG design from an ergonomics and human factor's perspective using retired and current astronauts with prior glovebox experience as subjects (Phase 1). In Phase 1, we used posture analysis, detailed astronaut interviews, reach and dissection tasks to evaluate lower body and torso restraint systems, gloveport size and location, window tilt angles, LSG work volume depth, and air location. Final Phase 1 recommendations for the LSG design also considered LSG requirements posed by NASA Ames Research Center.
Derived from text
Human Factors Engineering; Life Sciences; Laboratory Equipment; Space Laboratories; Evaluation

20000027529 NASA Marshall Space Flight Center, Huntsville, AL USA
Tenth Biennial Coherent Laser Radar Technology and Applications Conference
Kavaya, Michael J., Compiler, NASA Marshall Space Flight Center, USA; November 1999; 1p; In English; 10th; Coherent Laser Radar Technology and Applications, 28 Jun. - 2 Jul. 1999, Mount Hood, OR, USA
Report No.(s): NASA/CP-1999-209758; M-948; NAS 1.55:209758; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The tenth conference on coherent laser radar technology and applications is the latest in a series beginning in 1980 which provides a forum for exchange of information on recent events current status, and future directions of coherent laser radar (or lidar or lader) technology and applications. This conference emphasizes the latest advancement in the coherent laser radar field,

including theory, modeling, components, systems, instrumentation, measurements, calibration, data processing techniques, operational uses, and comparisons with other remote sensing technologies.
Author
Coherent Radar; Conferences; Optical Radar; Technology Utilization; Optical Heterodyning

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.

20000025479 ALTAIR Center, LLC, Marlborough, MA USA
Compound Core Active Multimore Fiber for High Efficiency Fiber Laser System ***Final Report, 15 Sep. 1998 - 14 Sep. 1999***
Krivoshlykov, S. G.; Sep. 14, 1999; 23p; In English
Contract(s)/Grant(s): F49620-98-C-0085
Report No.(s): AD-A372476; AFRL-SR-BL-TR-00-0016; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Altair Center proposed to develop a novel and innovative compound-core multimode active fiber for high-efficiency fiber laser systems capable to operate in a single-mode regime. During the Phase I project, the proposed concept was proved by simulating the fiber mode properties. The proposed compound-core fiber is an excellent candidate as a product in several markets, including: fiber lasers, telecommunication, wireless optical communication, electronic printing, remote sensing and monitoring, industrial cutting and welding, parametric frequency conversion, sensors, medical applications, etc.
DTIC
Fiber Lasers; Fiber Optics; Optical Communication

20000025492 Lebedev Physical Inst., Moscow, Russia
Frequency Tunable First-Overtone and Fundamental Band CO Laser System: Parametric Study, Gain Kinetics and Model Development for Highly Excited Vibrational Transitions of CO Molecule ***Final Report, Feb. - Dec. 1999***
Ionin, A.; Napartovich, A.; Konev, Yu.; Kotkov, A.; Seleznev, L.; Jan. 1999; 64p; In English; Prepared in collaboration with Troitsk Inst. for Innovation and Fusion Research, Troitsk, Russia, and Inst. of High Temperature, Moscow, Russia.
Contract(s)/Grant(s): F61775-99-W-E018
Report No.(s): AD-A372398; EOARD-SPC-99-4018; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
This report results from a contract tasking Lebedev Physics Institute as follows: The contractor will investigate physical processes in highly excited vibrational transitions (V of 20 to 40) of the CO molecule for use in frequency-selective first overtone and fundamental band CO lasers to include, but not be limited to, small signal gain and saturated gain kinetics.
DTIC
Carbon Monoxide Lasers; Tunable Lasers; Kinetics; Amplification; Molecular Energy Levels; Vibrational Spectra

20000025799 AdvR, Inc., Bozeman, MT USA
A Continuous Wave Raman Laser to Access a Broad Spectral Regime ***Final Report, 14 Jun. - 14 Dec. 1999***
Swanson, Rand, AdvR, Inc., USA; Dec. 14, 1999; 23p; In English
Contract(s)/Grant(s): F33615-99-C-1485
Report No.(s): AD-A372542; ADVR-0005; BMDO-99-001; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy
The purpose of this work was to explore the continuous wave (cw) Raman laser for generating high-power laser radiation in the Infra-Red (IR) spectral regime. This was done by numerically modeling cw Raman lasers. The numerical models were compared with results from recent experiments to confirm their accuracy. A survey was conducted to identify necessary components for this technology, including mirrors and pump lasers. Results indicate that the cw Raman laser can produce useful low-power laser radiation across the spectral range from 1 micrometers to 5 micrometers using commercially available diode lasers as pumps. Available pump lasers limit the ranges of wavelengths that can be produced at high-powers. Using real-world parameters, theory indicates photon conversion efficiencies of approximately 90% are possible. Independent experimental measurements have recorded efficiencies of over 60% without achieving optimal operating conditions. Additionally, the laser can be built to be compact, with longest dimensions on the order of 10 cm. Potential applications of the cw Raman laser include

generation of high-power eye-safe radiation, generation of high-power mid-IR laser radiation for IR countermeasures, and generation of a broad range of mid-IR wavelengths for spectroscopy applications.
DTIC
Continuous Wave Lasers; High Power Lasers; Infrared Spectra; Countermeasures; Raman Spectra; Laser Beams

20000027519 Duke Univ., Physics Dept., Durham, NC USA
Ultrastable CO2 Laser Trapping of Lithium Fermions
OHara, K. M., Duke Univ., USA; Granade, S. R, Duke Univ., USA; Gehm, M. E., Duke Univ., USA; Davard, T. A., Duke Univ., USA; Bali, S., Duke Univ., USA; Freed, C., Duke Univ., USA; Thomas, J. E., Duke Univ., USA; Physical Review Letters; May 24, 1999; ISSN 0031-9007; Volume 82, No. 21, pp. 4204-4208; In English
Contract(s)/Grant(s): DAAH04-96-I-0265
Report No.(s): AD-A369880; ARO-35169.4-PH; Copyright; Avail: Issuing Activity, Microfiche, Hardcopy

We demonstrate an ultrastable CO, law trap that provides fight confinement of neutral atoms with negligible optical scattering and minimal laser-noise-induced heating. Using this method, fermionic Li-6 atoms am stored in a 0.4 mK deep well with a 1/e trap lifetime of 300 sec. consistent with a background pressure of 10(exp -11) Torr. to our knowledge. this is the longest storage time ever achieved with an all-optical trap, comparable to the best reported magnetic trap.
Author
Carbon Dioxide Lasers; Fermions; Neutral Atoms; Optical Properties; Trapping

20000027525 Florida International Univ., Dept. of Physics, Miami, FL USA
Atom Guiding and Cooling in a Dark Hollow Laser Bean
Yin, Jianping, Florida International Univ., USA; Zhu, Yifu, Florida International Univ., USA; Jhe, Wonho, Seoul National Univ., Korea, Republic of; Wang, Zuzhu, Academia Sinica, China; Physical Review A; July 1998; ISSN 1050-2947; Volume 58, No. 1, pp. 58; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

We propose and analyze theoretically a scheme for atomic guiding and cooling in a dark hollow laser beam generated from the collimated output beam of a L P(0.1) I anode in a micrometer-sized hollow optical fiber. In the scheme, cold atoms from a magneto-optical trap are loaded into the blue-detuned dark hollow beam, move down in the dark hollow beam, and experience transverse Sisyphus cooling induced by the dark hollow beam and a weak re-pumping beam. In the longitudinal direction, the guided atoms experience heating from the gravity field and cooling from the upward-propagating dark hollow beam and re-pumping beam. We estimate the transverse two-dimensional equilibrium temperature, the final longitudinal mean velocity, and the total loss of the guided atoms. Our calculations show that a transverse equilibrium temperature of approx. 1.2 micro Ka final longitudinal mean velocity of 0 - 4.41 m/s, and a guiding efficiency of 65-95 % may be obtained.
Author
Atoms; Cooling; Laser Beams; Optical Fibers

20000027603 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
Diode Laser Measurements of HF Concentrations From Heptane/Air Pan Fires Extinguished by FE-36 and FE-36 Plus APP ***Final Report, Mar.-Apr. 1997***
Skaggs, R. R.; Daniel, R. G.; Miziolek, A. W.; McNesby, K. L.; Herud, C.; Jan. 2000; 30p; In English
Contract(s)/Grant(s): Proj-1L161102AH43
Report No.(s): AD-A373310; ARL-TR-2143; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Tunable diode laser absorption spectroscopy (TDLAS) is used to measure the time evolution of hydrogen fluoride (HF) concentrations produced from a series of enclosed heptane/air pan fires extinguished by FE-36 or FE-36 plus ammonium polyphosphate (APP). Recent advances in room temperature fiber coupled near infrared (NIR) diode lasers provide isolation of the laser and signal processing electronics from the hostile sampling site. For the fires studied, the change in HF gas concentration with time is dependent upon the fire fighting chemical used to extinguish the fire. The presence of APP is observed to accelerate the dissipation of HF from the fire enclosure. Visible attenuation spectroscopy is also used to measure the amount of light attenuation (obscuration) that occurs as a hand held fire extinguisher containing powder fire fighting agent is released in the crew space of a M1 Abrams land combat vehicle. Obscuration tests demonstrate that release of APP from extinguishers in an occupied space does not present a visibility challenge to the vehicle personnel.
DTIC
Fire Extinguishers; Hydrofluoric Acid; Diodes; Lasers

20000027627 Illinois Univ. at Urbana-Champaign, Dept. of Electrical and Computer Engineering, Urbana, IL USA
High-Bandwidth Direct Modulation of Distributed-Feedback Quantum-Well Lasers ***Final Report, 1 May 1996-31 Jul 1999***
Chuang, S. L.; Feb. 01, 2000; 55p; In English
Contract(s)/Grant(s): N00014-96-1-0902
Report No.(s): AD-A373344; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Wide-bandwidth microwave modulation of semiconductor strained quantum-well lasers using distributed feedback structures plays an important role in high bit-rate optical communication systems. It is therefore critical to conduct research on the device physics of strained semiconductor quantum-well lasers under high-frequency modulation and on the creation of new techniques to characterize high-speed quantum-well lasers. The goals of this project are (1) to design and fabricate high bandwidth distributed feedback quantum- well lasers using strain effects and (2) to combine microwave and optical measurement techniques to investigate the physics and device performance of quantum-well lasers under high-speed modulation conditions. The project is interdisciplinary in nature since optoelectronic device technology, microwave and optical measurement techniques will be introduced to the study of high-frequency modulation of quantum-well lasers for optical communication systems.
DTIC
Optoelectronic Devices; 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.

20000025397 AVL List G.m.b.H., Graz, Austria
Multi-Disciplinary Analysis in Engine Design
Mahmoud, Kamel G., AVL List G.m.b.H., Austria; Ennemoser, Andreas, AVL List G.m.b.H., Austria; Ninth Thermal and Fluids Analysis Workshop Proceedings; November 1999, pp. 139-152; In English; See also 20000025387
Contract(s)/Grant(s): ESPRIT Proj. 22746; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Automobile manufacturers are faced with a strong requirement today for developing high quality vehicles in a short period of time. Since the coolant system is playing a key role in vehicle performance, it is particularly important to be able to optimize the cooling cycle. Experimentally optimizing the complex three dimensional coolant system geometry has proven to be extremely difficult. Simulation tools provide engineering values that can be incorporated in the early stages of the design process where they complement the conventional experiment by virtual prototyping. Engine virtual prototyping has been the goal of AVL-Advanced Simulation Technologies business area for a couple of years. To improve the quality of the cooling system simulation results and to speed-up the simulation process, a multi-disciplinary (MD) analysis method has been developed by AVL in the frame work of the Multi-disciplinary Engineering Design via Unitary Software Applications MEDUSA project. In this MD analysis methodology, three different disciplines have been addressed to simulate the cooling of the cylinder head/block compound. The physical phenomena which are considered in simulating this cooling process are: the combustion in the combustion chamber, conduction in the engine structure, and convection and fluid flow in the cooling water jacket. Regarding the combustion, cycle-averaged gas temperature and convective heat transfer coefficient in the combustion chamber are calculated using a thermodynamic program, BOOST. Finite Element (FE) code, MSC/NASTRAN is used to calculate the temperature distribution in the structure where a Computational Fluid Dynamic (CFD) program, FIRE is used to calculate the flow field, and the fluid temperature and heat transfer coefficient in the water jacket. The cycle-averaged gas temperature and heat transfer coefficient in the combustion chamber are assumed to be wall temperature independent and coupling is carried out between the FE and CFD codes. Two approaches have been facilitated to perform the coupling. In the first approach a loose coupling is used, where the fluid-structure thermal interaction information are exchanged between the CFD and FE programs via file transfer. In the second approach, a tight coupling between the CFD and FE codes has been achieved. where the object libraries of FIRE and MSC/NASTRAN are linked and a single executable is generated. A 6 cylinders engine is used to demonstrate the MD coupling where the high performance computing facilities at AVL are used to carry out the calculations. Manually generated cooling water jacket mesh as well as a mesh generated using AVL Flexible Automatic Meshing Environment, FAME had been used for the CFD calculations. The simulation results have been checked against the experimental data and have shown to be comparable. It has

been shown that the current status of the high performance computing facilities makes it possible to carry out the MD simulation procedures within a reasonable time.
Author
Engine Design; Computational Fluid Dynamics; Applications Programs (Computers); Computerized Simulation; Cooling Systems

20000025428 NASA Langley Research Center, Hampton, VA USA
Carbon Fiber Reinforced Carbon Composites Rotary Valves for Internal Combustion Engines
Northam, G. Burton, Inventor, NASA Langley Research Center, USA; Ransone, Philip O., Inventor, NASA Langley Research Center, USA; Rivers, H. Kevin, Inventor, NASA Langley Research Center, USA; Jun. 01, 1999; In English; Provisional application US-Patent-Appl-SN-013306, filed 6 Mar. 1996
Patent Info.: Filed 6 Mar. 1997; NASA-Case-LAR-15498-1; US-Patent-5,908,016; US-Patent-Appl-SN-812826; US-Patent-Appl-SN-013306; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

Carbon fiber reinforced carbon composite rotary, sleeve, and disc valves for internal combustion engines and the like are disclosed. The valves are formed from knitted or braided or warp-locked carbon fiber shapes. Also disclosed are valves fabricated from woven carbon fibers and from molded carbon matrix material. The valves of the present invention with their very low coefficient of thermal expansion and excellent thermal and self-lubrication properties, do not present the sealing and lubrication problems that have prevented rotary, sleeve, and disc valves from operating efficiently and reliably in the past. Also disclosed are a sealing tang to further improve sealing capabilities and anti-oxidation treatments.
Official Gazette of the U.S. Patent and Trademark Office
Carbon Fibers; Carbon-Carbon Composites; Fiber Composites; Internal Combustion Engines; Valves

20000025501 NASA Langley Research Center, Hampton, VA USA
Inductive Systems for Bonding and Joining Pipes
Buckley, John D., Inventor, NASA Langley Research Center, USA; Fox, Robert L., Inventor, NASA Langley Research Center, USA; Johnson, Samuel D., Inventor, NASA Langley Research Center, USA; Copeland, Carl E., Inventor, NASA Langley Research Center, USA; Coultrip, Robert H., Inventor, NASA Langley Research Center, USA; Jul. 06, 1999; In English; Provisional Application US-Patent-Appl-SN-015968, filed 3 Apr. 1996
Patent Info.: Filed 3 Apr. 1997; NASA-Case-LAR-15273-1; US-Patent-5,919,387; US-Patent-Appl-SN-840110; US-Patent-Appl-SN-015968; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

A method for bonding or joining plastic or metallic pipe using induced energy is provided. A susceptor is placed between the two pipes to be joined and a magnetic flux is induced onto the susceptor. The second pipe may be a coupling device. The magnetic flux may be induced by a tank circuit or an induction heating gun. The induction heating gun may be formed with a hinged heating head. The susceptor may be a perforated metal ring or a wire coil. The susceptor is coated with a material compatible with the pipes, for example, a plastic adhesive material, magnetic flux is an induction heating gun having a hinged heating head.
Official Gazette of the U.S. Patent and Trademark Office
Bonding; Induction Heating; Magnetic Flux; Pipes (Tubes); Joints (Junctions)

20000025581 Army Construction Engineering Research Lab., Champaign, IL USA
Greaseless Bushings for Hydropower Applications: Program, Testing, and Results ***Final Report***
Jones, John A.; Palylyk, Rick A.; Willis, Paul; Weber, Robert A.; Dec. 1999; 124p; In English
Report No.(s): AD-A371845; CERL-TR-99/104; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The US Army Corps of Engineers (USACE) has been assessing the potential environmental and economic benefits of replacing greased or oiled bushings with greaseless (self-lubricated) bushings at its hydropower and navigation facilities. Products of this type currently on the market, however, were not specifically developed for the high-load, low-speed oscillating operating conditions typical for power-generation machinery. In-place testing of these materials on real-world hydroelectric equipment would pose too much risk of failure for critical facilities, and require many years to obtain meaningful performance comparisons. No standard specifications or laboratory tests for such applications have yet been developed and widely accepted. The U.S. Army Construction Engineering Research Laboratory (CERL) cooperated in a joint effort between the USACE Hydroelectric Design

Center (HDC; Portland, Oregon) and Powertech Laboratories Inc. (Surrey, BC, Canada) to use Power-tech's equipment and the combined hydroelectric expertise of HDC and Powertech Laboratories to develop standardized test procedures and a rating system for greaseless bushing materials intended for oscillating operation in high-load, low-speed conditions. An objective of this work was to evaluate a series of greaseless bushing materials using the new testing regimen. This report documents the development of the testing regimen, discusses the bearing rating procedure, and summarizes the results of the materials testing program.
DTIC
Bushings; Electric Power

20000025776 National Aerospace Lab., Tokyo Japan
Tribological Characteristics of Solid-Lubricated Ball Bearings at High Load Conditions in a Vacuum
Suzuki, M.; Nishimura, M.; Aug. 1999; 50p; In Japanese; Portions of this document are not fully legible
Report No.(s): PB2000-102568; NAL-TR-1389; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The performance of solid-lubricated ball bearings was examined under high load conditions in vacuum. The bearings had a sputtered MoS2 film on races and balls, and a PTFE-based composite retainer, and demonstrated low frictional torque of about 1.5 N cm even at a high load of 3 kN (the maximum Hertz contact pressure at the inner raceway of 2 Gpa), indicating that they were well lubricated with the sputtered MoS2 film. In some tests, torque spikes of 30 times higher value and with a duration of about 10 sec were observed at intervals of several hundred hours. When the MoS2 film wore out, frictional torque increased dramatically and the bearing temperature also rose to a high level, however the bearings did not seize. In the case of the ball bearings without MoS2 film, frictional torque was high, almost of the same level as that of the bearings with MoS2 film after the MoS2 film failure, and the bearing temperature also rose. Again no seizure occurred even after 1400 hours' operation. X-ray Photoelectron Spectroscopy (XPS) analyses of the tested balls revealed a metal fluoride on the surface. These results suggest that the torque rise observed at the MoS2 film failure was caused by the transition from MoS2-film-lubrication to metal-fluoride-lubrication. The performance of lead-lubricated ball bearings was also examined. Full ball type bearings without a retainer demonstrated a long life of more than 800 hours at a load of 3 kN, although the torque was 10 times higher than the bearings with a sputtered MoS2 film. It appears that lead-lubricated bearings are also feasible in high load applications.
NTIS
Tribology; Lubrication; Ball Bearings; Loads (Forces); High Vacuum; Sputtering; Molybdenum Disulfides; Polytetrafluoroethylene

20000027536 Illinois Univ., Dept. of Mechanical Engineering, Chicago, IL USA
Handbook on Face Gear Drives with a Spur Involute Pinion ***Final Report***
Litvin, F. L., Illinois Univ., USA; Egelja, A., Illinois Univ., USA; Tan, J., Boeing Co., USA; Chen, D. Y.–D., Boeing Co., USA; Heath, G., Boeing Co., USA; March 2000; 106p; In English
Contract(s)/Grant(s): NCC3-356; RTOP 581-30-13; DA Proj. 1L1-62211-A4-7A
Report No.(s): NASA/CR-2000-209909; NAS 1.26:209909; ARL-CR-447; E-12127; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The use of face gears in power transmission and drive systems has a significant number of benefits. Face gears allow a variety of new transmission arrangements as well as high reduction ratio capability. This leads to drive system weight reduction and improvements in performance. In this work, basic information about the design and analysis of face gear drives is presented. The work considers face gears in mesh with spur involute pinions for both intersecting axes and offset drives. Tooth geometry, kinematics, generation of face gears with localized bearing contact by cutting and grinding, avoidance of tooth undercutting, avoidance of tooth pointing, tooth contact analysis, and algorithms for the simulation of meshing and contact arc all topics which are discussed. In addition, applications of face gear drives are presented. Included are design uses in aerospace applications such as helicopter transmissions, split-torque face gear arrangements, comparisons of face gears with bevel gears, and general design considerations.
Author
Gears; Handbooks; Mechanical Drives; Design Analysis; Computerized Simulation; Racks (Gears)

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STRUCTURAL MECHANICS

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

20000025344 Massachusetts Inst. of Tech., Dept. of Mechanical Engineering, Cambridge, MA USA
Analytical Crashworthiness Methods Applied to Composite Structures
Lehnhardt, Keith W.; Jun. 1999; 108p; In English
Report No.(s): AD-A372202; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Several shell deformation models are developed for use in crashworthiness analysis of rotationally symmetric structures. These models use analytical techniques to predict the crushing force versus axial crush distance characteristics of both a rigid-plastic, hemispherical shell and an elastic, cylindrical shell loaded axially by a rigid flat plate. Additional methods are proposed to determine the effects of cutout sections and internal stiffening members on the crushing force capacity of the shells. These proposed methods are applied to determine the energy absorption capability of the composite/metal nose structure of a mini submarine subjected to a head-on impact with a flat rigid wall. The nose structure is composed of a stiffened composite shell that covers and is attached to the metal, forward, hemispherical portion of the pressure hull. The complex structure is simplified to a rotationally symmetric shell model and modified to account for the effects of stiffening elements and cutout sections. Laminated plate theory, a progressive composite failure method, and the models developed are then used to determine the structure's energy absorption capacity. The fairing structure is determined to be capable of absorbing the kinetic energy associated with an impact from an initial vehicle speed of 7.5 knots. Further, the entire nose structure (the fairing and forward pressure hull) is predicted to be able to absorb the kinetic energy from a 26.4 knot vehicle impact.
DTIC
Crashworthiness; Stiffening; Composite Structures; Composite Materials

20000027497 Ohio State Univ., Acoustics and Dynamics Lab., Columbus, OH USA
Structural Intensity Calculations for Compliant Plate-Beam Structures Connected by Bearings
Rook, T. E., Ohio State Univ., USA; Singh, R., Ohio State Univ., USA; Journal of Sound and Vibration; 1998; ISSN 0022-460X; Volume 211, No. 3, pp. 365-387; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

A computational strategy, based on component mobility and modal synthesis approaches , is described to calculate structural power flow through multi-dimensional connections such as rolling element bearings and joints. Research issues are discussed in the context of narrow band frequency analysis methods for vibration energy transmission and dissipation. Through the example case of a beam (shaft), ball bearings and an elastic machinery casing plate, the structural intensity calculation procedure is illustrated. A new pre-synthesis algorithm is outlined which is utilized to determine the effective stiffness of ball bearings while accounting for the compliance of the neighboring structure. e finite element method is used to facilitate computations and to generate structural intensity results in the post-synthesis mode. Sample results are included along with a discussion of various research issues.
Author
Algorithms; Ball Bearings; Elastic Plates; Elastic Properties; Stiffness; Vibration

20000027523 North Carolina State Univ., Materials Science and Engineering Dept., Raleigh, NC USA
Some Effects of an Electric Field on the Plastic Deformation of Metals and Ceramics
Conrad, Hans, North Carolina State Univ., USA; Material Research Innovation; 1998; Volume 2, pp. 1998; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The external parameters generally considered in the, plastic deformation of metals and ceramics are the temperature pressure or stress and time. Usually neglected are the effects of electric and magnetic fields. However, such fields can often have a significant influence, especially when applied concurrently with the more common parameters. Some examples of the effects of an electric field on the plastic deformation of metals and ceramics found by the author and his coworkers are presented. Included are the following: (a) the influence of electropulsing on the flow stress of metals at 78-300 K, (b) the effect of an external electric field (surface charge) on the superplastic deformation of the 74754 Al alloy, (c) the influence of an electric field on the flow stress and ductility of polycrystalline NaCl at 0.28-0.75 T(sub M) and (d) the effect of an electric field on the superplastic deformation of 3Y-TZP. Mechanisms responsible for the observed effects are considered.
Author
Electric Fields; Plastic Deformation; Ceramics; Metals; Polycrystals; Deformation

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EARTH RESOURCES AND REMOTE SENSING

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

20000025484 NASA Goddard Space Flight Center, Greenbelt, MD USA
Science Writers' Guide to TERRA
[2000]; 28p; In English
Report No.(s): NASA/NP-1999-10-169-GSFC; NAS 1.83:10-169-GSFC; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The launch of NASA's Terra spacecraft marks a new era of comprehensive monitoring of the Earth's atmosphere, oceans, and continents from a single space-based platform. Data from the five Terra instruments will create continuous, long-term records of the state of the land, oceans, and atmosphere. Together with data from other satellite systems launched by NASA and other countries, Terra will inaugurate a new self-consistent data record that will be gathered over the next 15 years. The science objectives of NASAs Earth Observing System (EOS) program are to provide global observations and scientific understanding of land cover change and global productivity, climate variability and change, natural hazards, and atmospheric ozone. Observations by the Terra instruments will: provide the first global and seasonal measurements of the Earth system, including such critical functions as biological productivity of the land and oceans, snow and ice, surface temperature, clouds, water vapor, and land cover; improve our ability to detect human impacts on the Earth system and climate, identify the "fingerprint" of human activity on climate, and predict climate change by using the new global observations in climate models; help develop technologies for disaster prediction, characterization, and risk reduction from wildfires, volcanoes, floods, and droughts, and start long-term monitoring of global climate change and environmental change.
Derived from text
Terra Spacecraft; NASA Space Programs; Earth Observing System (EOS); Earth Atmosphere

20000026853 NASA Goddard Space Flight Center, Greenbelt, MD USA
Science Writer's Guide to LANDSAT 7
November 1999; 24p; In English
Report No.(s): NASA/NP-1999-02-022-GSFC; NAS 1.83:02-022-GSFC; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Earth Observing System (EOS), the centerpiece of NASA's Earth science program, is a suite of spacecraft and interdisciplinary science investigations dedicated to advancing our understanding of global change. The flagship EOS satellite, Terra (formerly EOS AM-1), scheduled for launch in July 1999, will provide key measurements of the physical and radiative properties of clouds; air-land and air-sea exchanges of energy, carbon, and water; trace gases; and volcanoes. Flying in formation with Terra, LANDSAT 7 will make global high spatial resolution measurements of land surface and surrounding coastal regions. Other upcoming EOS missions and instruments include QuikSCAT, to collect sea surface wind data; the Stratospheric Gas and Aerosol Experiment (SAGE III), to create global profiles of key atmospheric gases; and the Active Cavity Radiometer Irradiance Monitors (ACRIM) to measure the energy output of the Sun. The second of the major, multi-instrument EOS platforms, PM-1, is scheduled for launch in 2000. Interdisciplinary research projects sponsored by EOS use specific Earth science data sets for a broader investigation into the function of Earth systems. Current EOS research spans a wide range of sciences, including atmospheric chemistry, hydrology, land use, and marine ecosystems. The EOS program has been managed since 1990 by the Goddard Space Flight Center in Greenbelt, Md., for NASA's Office of Earth Science in Washington, D. C. Additional information on the program can be found on the EOS Project Science Office Web site (http://eospso.gsfc.nasa.gov).
Author
Earth Observing System (EOS); Earth Surface; Terra Spacecraft; Earth Observations (From Space); LANDSAT 7

20000027512 NASA Goddard Space Flight Center, Greenbelt, MD USA
Path Radiance Technique for Retrieving Aerosol Optical Thickness Over Land
Tsay, S.–C., NASA Goddard Space Flight Center, USA; Wen, G., NASA Goddard Space Flight Center, USA; Cahalan, R. F., NASA Goddard Space Flight Center, USA; Oreopoulos, L., NASA Goddard Space Flight Center, USA; 1999; 1p; In English; 2nd; Satellite-Remote Sensing of Aerosols and Clouds and its Climate Study Applications, 30 Nov. - 10 Dec. 1999, Kyoto, Kyoto, Japan, Japan; Sponsored by National Space Development Agency, Japan; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The key issue in retrieving aerosol optical thickness over land from shortwave satellite radiances is to identify and separate the signal due to scattering by a largely transparent aerosol layer from the noise due to reflection by the background surface, where the signal is relatively uniform compared to the highly inhomogeneous surface contribution. Sensitivity studies in aerosol optical thickness retrievals reveal that the apparent reflectance at the top of the atmosphere is very susceptible to the surface reflectance, especially when aerosol optical thickness is small. Uncertainties associated with surface reflectance estimation can greatly amplify the error of the aerosol optical thickness retrieval. to reduce these uncertainties, we have developed a ”path radiance” method to retrieve aerosol optical thickness over land by extending the traditional technique that uses the ”dark object” approach to extract the aerosol signal. This method uses the signature of the correlation of visible and mid-IR reflectance at the surface, and couples the correlation with the atmospheric effect. We have applied this method to a LANDSAT TM (Thematic Mapper) image acquired over the Oklahoma Southern Great Plains (SGP) site of DoE’s ARM (Department of Energy’s Atmospheric Radiation Measurement) program on September 27,1997, a very clear day (aerosol optical thickness of 0.07 at 0.5 microns) during the first LANDSAT Intensive Observation Period (IOP). The retrieved mean aerosol optical thickness for TM band 1 at 0.49 micron and band 3 at 0.66 micron agree very well with the ground-based sun-photometer measurements at the ARM site. The ability to retrieve small aerosol optical thickness makes this path radiance technique promising. More importantly, the path radiance is relatively insensitive to surface inhomogeneity. The retrieved mean path radiances in reflectance units have very small standard deviations for both TM blue and red bands. This small variability of path radiance further supports the current aerosol retrieval method.

Author

Aerosols; Atmospheric Effects; Optical Thickness; Radiance; Spectral Reflectance; Remote Sensing; Earth Observations (From Space)

20000027513 NASA Goddard Space Flight Center, Greenbelt, MD USA

On the Dome Effect of Flux Radiometers to Radiative Forcing

Tsay, S.–C., NASA Goddard Space Flight Center, USA; Ji, Q., NASA Goddard Space Flight Center, USA; 1999; 1p; In English; 2nd; Satellite-Remote Sensing of Aerosols and Clouds and its Climate Study Applications, 30 Nov. - 10 Dec. 1000, Kyoto, Kyoto, Japan, Japan; Sponsored by National Space Development Agency, Japan; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Since the introduction of thermopile, pyranometers (solar, e.g., 0.3-3.0 microns) and pyrgeometers (terrestrial, e.g., 4-50 microns) have become instruments commonly used for measuring the broadband hemispherical irradiances at the surface in a long-term, monitoring mode for decades. These commercially available radiometers have been manufactured in several countries such as from the USA, Asia, and Europe, and are generally reliable and economical. These worldwide distributions of surface measurements become even more important in the era of Earth remote sensing in studying climate forcing. However, recent studies from field campaigns have pointed out that erroneous factors (e.g., temperature gradients between the filter dome and detector, emissivity of the thermopile) are responsible for the unacceptable level of uncertainty (e.g., 10-20 W/square Meter). Using a newly developed instrument of Quantum Well Infrared Photodetector (QWIP), we have characterized the brightness temperature fields of pyranometers and pyrgeometers under various sky conditions. The QWIP is based on the superlattice (GaAs/AlGaAs) technology and has a noise equivalent temperature (NE delta T) less than 0.1 K. The quality of pyranometer and pyrgeometer measurements can be improved largely by applying proper knowledge of the thermal parameters affecting the operation of the thermopile systems. For example, we show a method to determine the ”dome factor” (the longwave emission divided by the longwave transmission of a pyrgeometer dome) from field measurements. The results show, and are verified independently by the QWIP, that our dome factors of 0.59 and 0.90 are much smaller than the value of 4.0 assumed by the WMO. Data correction procedure and algorithm will be presented and discussed.

Author

Algorithms; Brightness Temperature; Correction; Photometers; Quantum Wells; Temperature Gradients; Long Wave Radiation

20000027514 NASA Goddard Space Flight Center, Greenbelt, MD USA

Return Echoes from Medium-Large Footprint Laser Altimeters

Blair, J. Bryan, NASA Goddard Space Flight Center, USA; Hofton, Michelle A., Maryland Univ., USA; Rabine, David L., Science Systems and Applications, Inc., USA; [1999]; 1p; In English; Sponsored by International Society for Photogrammetry d Remote Sensing, Unknown; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

For just over 10 years, NASA Goddard Space Flight Center has been at the forefront of developing return echo laser altimeters and analysis techniques for a variety of both space and airborne applications. In 1991, the Laser Remote Sensing Branch began investigating the use of medium-large diameter footprint return waveforms for measuring vegetation height and structure and sub-canopy topography. Over the last 8 years, using a variety of profiling and scanning laser altimeters (i.e. ATLAS, SLICER,

SLA, and LVIS), we have collected return waveforms over a variety of terrestrial surface types. We describe the effects of instrument characteristics and within-footprint surface structure on the shape of the return waveform and suggest several techniques for extracting this information. Specifically for vegetation returns, we describe the effects of canopy parameters such as architecture and closure on the shape of the return waveform. Density profiles, statistics, and examples from a variety of vegetation types will be presented, as well as comparisons with small-footprint laser altimeter data.
Author
Laser Altimeters; Remote Sensing; Topography; Vegetation; Waveforms

20000027561 NASA Goddard Space Flight Center, Greenbelt, MD USA
Global-Scale Hydrology: Simple Characterization of Complex Simulation
Koster, Randal D., NASA Goddard Space Flight Center, USA; Apr. 02, 1999; In English, 2 Apr. 1999, Boston, MA, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

Atmospheric general circulation models (AGCMS) are unique and valuable tools for the analysis of large-scale hydrology. AGCM simulations of climate provide tremendous amounts of hydrological data with a spatial and temporal coverage unmatched by observation systems. to the extent that the AGCM behaves realistically, these data can shed light on the nature of the real world's hydrological cycle. In the first part of the seminar, I will describe the hydrological cycle in a typical AGCM, with some emphasis on the validation of simulated precipitation against observations. The second part of the seminar will focus on a key goal in large-scale hydrology studies, namely the identification of simple, overarching controls on hydrological behavior hidden amidst the tremendous amounts of data produced by the highly complex AGCM parameterizations. In particular, I will show that a simple 50-year-old climatological relation (and a recent extension we made to it) successfully predicts, to first order, both the annual mean and the interannual variability of simulated evaporation and runoff fluxes. The seminar will conclude with an example of a practical application of global hydrology studies. The accurate prediction of weather statistics several months in advance would have tremendous societal benefits, and conventional wisdom today points at the use of coupled ocean-atmosphere-land models for such seasonal-to-interannual prediction. Understanding the hydrological cycle in AGCMs is critical to establishing the potential for such prediction. Our own studies show, among other things, that soil moisture retention can lead to significant precipitation predictability in many midlatitude and tropical regions.
Author
Hydrological Cycle; Hydrology; Air Water Interactions; Atmospheric Models; Predictions

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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.

20000025503 NASA Lewis Research Center, Cleveland, OH USA
High Temperature Solar Reflector, Its Preparation and Use
Jaworske, Donald A., Inventor, NASA Lewis Research Center, USA; Jun. 15, 1999; In English
Patent Info.: Filed 26 Jun. 1997; NASA-Case-LEW-16411-1; US-Patent-5,912,777; US-Patent-Appl-SN-903195; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

A coating-substrate combination having high specular reflectivity at high temperatures reaching 8000 C in a vacuum is described. The substrate comprises pure nickel metal or a nickel-containing metal alloy such as stainless steel having a highly polished reflective surface. The coating is a layer of silver deposited on the substrate to a thickness of 300 A to 3000 A. A 300 A to 5000 A protective coating of silica, alumina or magnesium fluoride is used to cover the silver and to protect it from oxidation. The combination is useful as a parabolic shaped secondary concentrator for collecting solar radiation for generating power or thermal energy for satellite uses. The reflective layer and protective coating preferably are applied to the reflective surface of the substrate by electron beam evaporation or by ion sputtering.
Official Gazette of the U.S. Patent and Trademark Office
High Temperature; Nickel Alloys; Protective Coatings; Solar Reflectors; Reflectance

20000027386 Criswell (David R.), Houston, TX USA
Lunar Solar Power System and Lunar Development
Criswell, David R., Criswell (David R.), USA; Space Resources Utilization Roundtable; 1999, pp. 3-4; In English; See also

20000027384; Copyright Waived; Avail: CASI; A01, Hardcopy; A01, Microfiche

The LSP System consists of pairs of bases on opposing limbs of the Moon that capture sunlight, convert solar power to microwaves, and beam the power to receivers on Earth called rectennas. Redirector satellites in orbit about Earth can provide load-following power to receivers that cannot view the Moon. The low intensity beams, 5 to 20% the intensity of sunlight, are unaffected by rain, clouds, or dust. A person can obtain 2 kWe from only 10 meters squared of rectenna surface when the beam operates at approx. 200 We/meters squared or less than or equal to 20% of the intensity of sunlight. Studies indicate that a demonstration LSP can supply energy at lower cost (less than or equal to 3 cents/kWe-h) than conventional terrestrial options such as fossil, nuclear, or terrestrial solar plants. LSP can provide greater levels of power (greater than or equal to 20,000 GWe) than all other proposed large-scale systems. The mature LSP can provide power at less than or equal to 1 cent/kWe-h, possibly much less. Note that 1 cent/kWe-h implies approx. 200 $/Y-person for 2 kWe/person. Low-cost, abundant, and clean electric power can stimulate economic growth and benefit human health in the Developing Nations.

Derived from text

Solar Energy; Lunar Evolution; Moon; Economics

20000027396 Colorado State Univ., Center for Engineering Infrastructure and Sciences in Space, Fort Collins, CO USA

Solar Energy Conversion Using In Situ Lunar Soil

Perko, Howard A., Colorado State Univ., USA; Space Resources Utilization Roundtable; 1999, pp. 23-24; In English; See also 20000027384; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The success of future long duration robotic and manned missions to the Moon and a permanently human occupied lunar base depends on the ability to cenerate electric power on the Moon. It has been suggested that solar cells might be manufactured on the Moon using silicon and titanium extracted from the lunar soil. However, this requires the delivery and operation of materials handling equipment and a fairly sophisticated manufacturing facility. It has been shown that the lunar soil itself is capable of generating considerable electrostatic charge due to changes in illumination and secondary electron emission. These phenomena combined with high photoconductivity, considerable spectral absorption, and the abundant radiation on the Moon, suggest that solar energy conversion might be performed using in situ lunar soil. The possibility of generating electricity from the lunar soil was explored for a hypothetical Schottky barrier photovoltaic cell consisting of an aluminum wire mesh bearing on a thin layer of compacted fine lunar soil underlain by a metallic foil.

Author

Solar Energy Conversion; Lunar Soil; Moon; Manned Space Flight

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ENVIRONMENT POLLUTION

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

20000025299 NASA Goddard Space Flight Center, Greenbelt, MD USA

The Impact of Withholding Observations from TOMS or SBUV Instruments on the GEOS Ozone Data Assimilation System

Stajner, Ovanka, NASA Goddard Space Flight Center, USA; Riishojgaard, Lars Peter, NASA Goddard Space Flight Center, USA; Rood, Richard B., NASA Goddard Space Flight Center, USA; [2000]; 4p; In English; 80th, 9-14 Jan. 2000, Long Beach, CA, USA; Sponsored by American Meteorology Society, USA

Contract(s)/Grant(s): NAS5-32332; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In a data assimilation system (DAS), model forecast atmospheric fields, observations and their respective statistics are combined in an attempt to produce the best estimate of these fields. Ozone observations from two instruments are assimilated in the Goddard Earth Observing System (GEOS) ozone DAS: the Total Ozone Mapping Spectrometer (TOMS) and the Solar Backscatter Ultraviolet (SBUV) instrument. The assimilated observations are complementary; TOMS provides a global daily coverage of total column ozone, without profile information, while SBUV measures ozone profiles and total column ozone at nadir only. The purpose of this paper is to examine the performance of the ozone assimilation system in the absence of observations from one of the instruments as it can happen in the event of a failure of an instrument or when there are problems with an instrument for a limited time. Our primary concern is for the performance of the GEOS ozone DAS when it is used in the operational mode to provide near real time analyzed ozone fields in support of instruments on the Terra satellite. In addition, we are planning to produce a longer term ozone record by assimilating historical data. We want to quantify the differences in the assimilated ozone fields that are caused by the changes in the TOMS or SBUV observing network. Our primary interest is in long term and large scale features visible in global statistics of analysis fields, such as differences in the zonal mean of assimilated ozone fields or

comparisons with independent observations, While some drifts in assimilated fields occur immediately, after assimilating just one day of different observations, the others develop slowly over several months. Thus, we are also interested in the length of time, which is determined from time series, that is needed for significant changes to take place.
Author
Total Ozone Mapping Spectrometer; Solar Backscatter UV Spectrometer; Earth Observing System (EOS); Data Systems; Assimilation; Ozone

20000025312 Wisconsin Univ., Space Science and Engineering Center, Madison, WI USA
Cloud Statistics for NASA Climate Change Studies ***Final Report, 18 Apr. 1996 - 17 Apr. 1999***
Wylie, Donald P., Wisconsin Univ., USA; 1999; 17p; In English
Contract(s)/Grant(s): NAG1-1830; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Principal Investigator participated in two field experiments and developed a global data set on cirrus cloud frequency and optical depth to aid the development of numerical models of climate. Four papers were published under this grant. The accomplishments are summarized: (1) In SUCCESS (SUbsonic aircraft: Contrail & Cloud Effects Special Study) the Principal Investigator aided weather forecasters in the start of the field program. A paper also was published on the clouds studied in SUCCESS and the use of the satellite stereographic technique to distinguish cloud forms and heights of clouds. (2) In SHEBA (Surface Heat Budget in the Arctic) FIRE/ACE (Arctic Cloud Experiment) the Principal Investigator provided daily weather and cloud forecasts for four research aircraft crews, NASA's ER-2, UCAR's C-130, University of Washington's Convert 580, and the Canadian Atmospheric Environment Service's Convert 580. Approximately 105 forecasts were written. The Principal Investigator also made daily weather summaries with calculations of air trajectories for 54 flight days in the experiment. The trajectories show where the air sampled during the flights came from and will be used in future publications to discuss the origin and history of the air and clouds sampled by the aircraft. A paper discussing how well the FIRE/ACE data represent normal climatic conditions in the arctic is being prepared. (3) The Principal Investigator's web page became the source of information for weather forecasting by the scientists on the SHEBA ship. (4) Global Cirrus frequency and optical depth is a continuing analysis of global cloud cover and frequency distribution are being made from the NOAA polar orbiting weather satellites. This analysis is sensitive to cirrus clouds because of the radiative channels used. During this grant three papers were published which describe cloud frequencies, their optical properties and compare the Wisconsin FM Cloud Analysis to other global cloud data such as the International Satellite Cloud Climatology Program (ISCCP) and the Stratospheric Aerosol and Gas Experiment (SAGE). A summary of eight years of HIRS data will be published in late 1998. Important information from this study are: 1) cirrus clouds cover most of the earth, 2) they are found about 40% of the time globally, 3) in the tropics cirrus cloud frequencies are even higher, from 80-100%, 4) there is slight evidence that cirnis cloud cover is increasing in the northern hemisphere at about 0.5% per year, and 5) cirrus clouds have an average infrared transmittance of about 40% of the terrestrial radiation. (5) Global Cloud Frequency Statistics published on the Principal Investigator's web page have been used in the planning of the future CRYSTAL experiment and have been used for refinements of a global numerical model operated at the Colorado State University.
Derived from text
Arctic Regions; Cirrus Clouds; Climatology; Cloud Cover; Clouds (Meteorology); Optical Properties; Optical Thickness; Terrestrial Radiation; Climate Change; Meteorology; Weather Forecasting

20000025528 Swedish Water and Air Pollution Research Lab., Stockholm, Sweden
Environmental Valuation of NMP as Cleaning Material ***Miljoeteknisk Utvaerdering av NMP som Rengoeringsmedel***
Nilsson, M.; Pleijel, K.; Nov. 1998; 52p; In Swedish
Report No.(s): PB2000-102751; IVL-B-1309; No Copyright; Avail: National Technical Information Service (NTIS)

N-methyl-2-pyrrolidone (NMP) has been brought up as an alternative to trichloro ethylene for degreasing and cleaning purposes. In this study, no companies that have changed from trichloro ethylene to NMP could be identified. However, there are some companies that have changed from methylene chloride to NMP. In this study, three companies were visited. The companies have changed from cleaning agents based on methylene chloride to NMP. At each company, the cleaning equipment and methods of work were studied. Interviews and air monitoring were carried out at every company. The goods were dipped in a solution of NMP and sprayed with water. The goods were of steel or aluminium and paint or rubber was washed off. The general opinion of the companies about NMP was that it is efficient and that the goods are sufficiently clean. However, the work is often considered as heavy since there is a lot of lifting, and since the work requires a lot of safety equipment. Studies have shown that the uptake of NMP to a great part depends on skin penetration. NMP is irritating to skin and eye. Additionally, it enhances skin penetration of other compounds. According to environmental aspects, used NMP should be treated as toxic waste. NMP emitted to air can have indirect effects such as formation of photochemical ozone. Emission to water (pure NMP) have not shown any toxic effects

on the aquatic environment. The emissions of NMP to water and air from the companies visited in this study have been estimated to be negligible.
NTIS
Environmental Monitoring; Methyl Compounds; Cleaning; Air Quality; Environment Effects

20000025529 Environmental Protection Agency, Office of Air and Radiation, Washington, DC USA
Driving Investment in Energy Efficiency: ENERGY STAR (Trade Name) and Other Voluntary Programs ***Annual Report***
Jul. 1999; 40p; In English
Report No.(s): PB2000-102821; EPA/430/R-99/005; No Copyright; Avail: National Technical Information Service (NTIS)
This annual report summarizes the environmental and economic results from the partnership programs of the Climate Protection Division through the end of 1998: Energy Star Buildings(SM) and Green Lights(Trademark); Energy Star(Trademark)-Labeled Products; Methane Partnerships; and Environmental Stewardship Programs.
NTIS
Economics; Environment Protection

20000025532 Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC USA
Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities: Peer Review Draft, Volume 2, Appendix A
Nov. 1999; 320p; In English
Report No.(s): PB2000-101331; EPA/530/D-99/001B; No Copyright; Avail: National Technical Information Service (NTIS)
Contents include the following: Appendix A - Chemical-Specific Data: Chemicals for Consideration as Compounds of Potential Concern; and Compound Specific Parameter Values.
NTIS
Protocol (Computers); Hazardous Wastes; Risk; Combustion; Ecosystems

20000025533 Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC USA
Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities: Peer Review Draft, Volume 3, Appendices B-H
Nov. 1999; 700p; In English
Report No.(s): PB2000-101332; EPA/530/D-99/001C; No Copyright; Avail: National Technical Information Service (NTIS)
Contents include the following: Estimating Media Concentration Equations and Variable Values; Media-to-Receptor Bioconcentration Factors (BCFs); Bioconcentration Factors (BCFs) for Wildlife Measurement Receptors; Toxicity Reference Values; Equations for Computing COPC Concentrations and COPC Dose Ingested Terms; State Natural Heritage Programs; and Toxicological Profiles.
NTIS
Risk; Protocol (Computers); Hazardous Wastes; Ecosystems

20000025536 Tetra Tech Environmental Management, Inc., Cincinnati, OH USA
Superfund Innovative Technology Evaluation Program: Technology Profiles. Tenth Edition, Volume 1, Demonstration Program
Jul. 1999; 394p; In English
Report No.(s): PB2000-102921; EPA/540/R-99/500A; No Copyright; Avail: National Technical Information Service (NTIS)
The US Environmental Protection Agency's (EPA) Superfund Innovative Technology Evaluation (SITE) includes the 'Demonstration Program' which evaluates and verifies cost and performance of promising innovative technologies at selected hazardous waste sites to provide reliable performance, cost, and applicability information for site clean-up decision making. The Demonstration Program currently has 106 developers conducting 116 demonstrations. of these projects, 85 demonstrations are complete and 28 are ongoing. The projects are divided into the following categories: thermal destruction (1), biological degradation (21), physical/chemical treatment (45), solidification/stabilization (10), physical/chemical radioactive waste treatment (2), physical/chemical thermal desorption (19), physical/chemical biological degradation (1), materials handling (3), and other (2). Several technologies represent more than one treatment category.
NTIS
Environment Protection; Environmental Cleanup; Pollution Control

20000025578 Tetra Tech Environmental Management, Inc., Cincinnati, OH USA

Superfund Innovative Technology Evaluation Program. Technology Profiles: Tenth Edition, Volume 3, Monitoring and Measurement Program

Jul. 1999; 240p; In English

Report No.(s): PB2000-102923; EPA/540/R-99/500C; No Copyright; Avail: National Technical Information Service (NTIS)

The US Environmental Protection Agency's (EPA) Superfund Innovative Technology Evaluation (SITE) includes the 'Monitoring and Measurement Technologies Program' which evaluates technologies that detect, monitor, and measure hazardous and toxic substances to provide more cost-effective methods for producing real-time data during site characterization and remediation. The Monitoring and Measurement Technologies (MMT) Program's goal is to assess innovative and alternative monitoring, measurement, and site characterization technologies. to date, 38 technology demonstrations have occurred under the MMT Program. These demonstrations have included four cone penetrometers, 6 field portable x-ray fluorescence.

NTIS

Environmental Cleanup; Environment Protection; Pollution Control; Waste Treatment

20000025769 College of William and Mary, Dept. of Physics, Williamsburg, VA USA

High Resolution Spectroscopy to Support Atmospheric Measurements ***Final Report, Jul. 1983 - Apr. 2000***

Benner, D. Chris, College of William and Mary, USA; Venkataraman, Malathy Devi, College of William and Mary, USA; [2000]; 22p; In English

Contract(s)/Grant(s): NCC1-80; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The major research activities performed during the cooperative agreement enhanced our spectroscopic knowledge of molecules of atmospheric interest such as carbon dioxide, water vapor, ozone, methane, and carbon monoxide, to name a few. Measurements were made using the NASA Langley Tunable Diode Laser Spectrometer System (TDL) and several Fourier Transform Spectrometer Systems (FTS) around the globe. The results from these studies made remarkable improvements in the line positions and intensities for several molecules, particularly ozone and carbon dioxide in the 2 to 17-micrometer spectral region. Measurements of pressure broadening and pressure induced line shift coefficients and the temperature dependence of pressure broadening and pressure induced line shift coefficients for infrared transitions of ozone, methane, and water vapor were also performed. Results from these studies have been used for retrievals of stratospheric gas concentration profiles from data collected by several Upper Atmospheric Research satellite (UARS) infrared instruments as well as in the analysis of high resolution atmospheric spectra such as those acquired by space-based, ground-based, and various balloon-and aircraft-borne experiments. Our results made significant contributions in several updates of the HITRAN (HIgh resolution TRANsmission) spectral line parameters database. This database enjoys worldwide recognition in research involving diversified scientific fields. Author

High Resolution; Upper Atmosphere; Laser Spectrometers; Tunable Lasers; Fourier Transformation

20000025795 Tennessee Valley Authority, Muscle Shoals, AL USA

3-Demonstration Results of Phytoremediation of Explosives-Contaminated Groundwater Using Constructed Wetlands at the Milan Army Ammunition Plant, Milan, Tennessee Volume 3 ***Final Report***

Dec. 1998; 435p; In English

Contract(s)/Grant(s): TVA-TV-88826V

Report No.(s): AD-A372288; SFIM-AEC-ET-CR-97059; No Copyright; Avail: CASI; A19, Hardcopy; A04, Microfiche

This report describes a demonstration of phytoremediation methods to remediate explosives-contaminated groundwater. The demonstration was conducted at the Milan Army Ammunition Plant near Milan, Tennessee, using a gravel-based subsurface flow wetland and a lagoon-based surface flow wetland. The report provides demonstration results as they are related to the effectiveness of the wetlands; and provides cost and other information necessary for the transfer of the technology to the user community. The report concludes that gravel-based wetlands could be used to remediate groundwater contaminated with a variety of explosives including TNT and RDX and that, based on the demonstration results, the use of lagoon-based wetlands could not be recommended.

DTIC

Explosives; Ground Water; Water Pollution; Contamination; Technology Transfer

20000026822 Environmental Protection Agency, Cincinnati, OH USA

Waste Research Strategy

Feb. 1999; 80p; In English

Report No.(s): PB2000-102835; EPA/600/R-98/154; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This document describes a strategy to focus waste research at a national level to reduce the greatest risks to people and the environment. This strategy identifies four research topic areas which correspond to the major waste-related environmental problems (contaminated ground water, contaminated soil/vadose zone, emissions from waste combustion facilities, and active waste management facilities). The strategy prioritizes research activities that ORD should undertake through Fiscal Year 2000 (FY00). This report is organized into three chapters. Chapter 1 summarizes the major waste problems facing the United States, associated risks to human health and the environment, and costs of proper management and cleanup. Chapter 2 contains the essence of the strategy. It first lists waste research needs; then describes the four environmental problem areas plus technical support along with related research activities for each topic; and finally presents the ranking of the activities with the rationables from the rankings. The conclusions of the strategy are discussed in Chapter 3 along with outstanding issues that require further evaluation.
NTIS
Research and Development; Priorities; Strategy; Planning

20000026823 Midwest Research Inst., Kansas City, MO USA
FTIR and Method 25A Emissions Test at an Integrated Iron and Steel Manufacturing Plant: Youngstown Sinter Company of WCI Steel, Inc., Youngstown, Ohio
Sep. 1999; 376p; In English
Report No.(s): PB2000-102824; No Copyright; Avail: CASI; A17, Hardcopy; A03, Microfiche
The purpose of this testing program was to obtain emissions data by using FTIR and EPA Method 25a on a sintering process to quantify and characterize HAP and other detected emissions and the performance of the control unit for MACT standard development for this industry (Integrated Iron and Steel).
NTIS
Air Pollution; Air Sampling; Pollution Monitoring; Iron; Steels

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.

20000025298 Utah State Univ., Logan, UT USA
An Investigation of Variable Time Interval ”K-like” Geomagnetic Indices
Della–Rose, Devin J.; Dec. 16, 1999; 134p; In English
Report No.(s): AD-A372302; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
The 3-hour planetary K index derivative, KP, is designed to measure irregular fluctuations in the Earth’s magnetic field due to currents in the magnetosphere-ionosphere system. The index is widely used to drive empirical models of auroral particle precipitation, high-latitude convection patterns, thermospheric composition, and neutral winds. The 3-hour time interval of KP makes it suitable for use as a parameter in thermospheric models, since the neutral atmosphere changes slowly. However, ionospheric time constants can be quite short, and this makes the 3-hour interval too coarse for accurate modeling. My research examined the feasibility of improving ionospheric modeling via use of a ”K-like” index with a variable time interval. We first created an algorithm to create such indices (following the same definitions as used in the traditional 3-hour index), then applied the code to the 1990-1992 raw data set from the Fredericksburg, Virginia, magnetometer.
DTIC
Geomagnetism; Thermosphere; Earth Ionosphere; Particle Precipitation; Atmospheric Models; Earth Magnetosphere

20000025305 Kyoto Univ., World Data Center for Geomagnetism, Japan
Data Catalogue, No. 25
Takeda, M., Compiler, Kyoto Univ., Japan; Iyemori, T., Compiler, Kyoto Univ., Japan; Kamei, T., Compiler, Kyoto Univ., Japan; October 1999; 174p; In English; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche
This data catalogue was published as the World Data Center (WDC) C2 for Geomagnetism by the Data Analysis Center for Geomagnetism and Space Magnetism, Faculty of Science, Kyoto University. This catalogue gave geomagnetism data collected by the WDC. This catalogue showed the alphabetical list of the stations, alternative station list, status of data collection (hourly values of geomagnetism, one-minute of digital values of geomagnetism, normal-run magnetogram, rapid-run magnetogram, hourly values of earth current, normal-run tellurigram, rapid-run tellurigram), samples of analogue data (hourly values of

geomagnetism, normal-run magnetogram, rapid-run magnetogram, normal-run tellurigram, rapid-run tellurigram), publications, distribution of geomagnetic observatories, contour maps of geomagnetic elements, and online digital data format.
CASI
Digital Data; Geomagnetism; Magnetic Signatures; Analog Data

20000025335 NASA Goddard Space Flight Center, Greenbelt, MD USA
1DVAR Analysis of Temperature and Humidity using GPS Radio Occulation Data
Poli, Paul, NASA Goddard Space Flight Center, USA; Joiner, Joanna, NASA Goddard Space Flight Center, USA; Kursinski, Robert, Jet Propulsion Lab., California Inst. of Tech., USA; Kolodner, Marc, NASA Goddard Space Flight Center, USA; [2000]; 4p; In English; 80th, 9-14 Jan. 2000, Long Beach, CA, USA; Sponsored by American Meteorology Society, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The Global Positioning System (GPS) enables positioning with a very small receiver. The signals transmitted by the GPS satellites are sensitive to the atmosphere and can be used to perform soundings with the radio occultation technique (e.g., Kursinski et al., 1997). The GPS signal can be converted to refractivity N via the Abel transform. The refractivity can then be related to atmospheric pressure P, temperature T, and water vapor partial pressure P (sub w) the GPS measurement, (between 0.5 and 1.5 km), its self-calibration, and it's nearly all-weather capabilities make it a good candidate for use in data assimilation systems (DAS) and numerical weather prediction (NWP). In order to demonstrate its usefulness in a DAS or NWP system, a first step is to assess its impact oil the analysis. A one-dimensional variational off-line analysis (1DVAR), meaning the data are not assimilated 'In the 3D DAS, constitutes a starting approach to which further enhancements can be made. The chosen observable to be analyzed in this study is the refractivity. One way to extract temperature (humidity) from the refractivity, is to assume a humidity (temperature) profile. One variable may then be retrieved without any a priori information. The 1DVAR approach used here resolves the ambiguity problem raised in the interpretation of these data. It enables retrieving these two atmospheric variables at a reasonable computing cost.
Author
Radio Occultation; Global Positioning System; Numerical Weather Forecasting; Temperature Profiles; Humidity; Mathematical Models; Data Systems

20000025472 Johns Hopkins Univ., Applied Physics Lab., Laurel, MD USA
Atomic Oxygen Database for Models ***Final Report, 1 Dec. 1998 - 30 Nov. 1999***
Swaminathan, Pazhayannur K.; Yee, Jeng–Hwa; Jan. 10, 2000; 9p; In English
Contract(s)/Grant(s): N00173-99-1-G001
Report No.(s): AD-A372448; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The object of this research was to develop an analytically represented empirical database of terrestrial atmospheric atomic oxygen abundance, O(3-P), at an altitude of 95 km. This final report summarizes the research findings and also discusses scientific issues related to the climatological variability as a guide for the proper use of the current analytical representation of the UARS 95 km O(3-P) database. The results are provided to guide the Spill Model Integrated Product Team (SMIPT) effort that aims to develop a detailed model of trail radiance from fuel vents due to reactions with atmospheric atomic oxygen.
DTIC
Oxygen Atoms; Data Bases

20000025754 Kyushu Univ., Faculty of Science, Fukuoka, Japan
Upper Crustal Structure in the Eastern Part of Kyushu, Japan, Inferred from Seismic Refraction Experiments
Tashiro, Katsuya, Kyushu Univ., Japan; Suzuki, Sadaomi, Kyushu Univ., Japan; Matsushima, Takeshi, Kyushu Univ., Japan; Miyamachi, Hiroki, Kagoshima Univ., Japan; Iwasaki, Takaya, Tokyo Univ., Japan; Yoshii, Toshikatsu, Tokyo Univ., Japan; Takeda, Tetsuya, Tokyo Univ., Japan; Piao, Chengshi, Tokyo Univ., Japan; Sakai, Shinnichi, Tokyo Univ., Japan; Iidaka, Takashi, Tokyo Univ., Japan; Science Reports, Department of Earth and Planetary Sciences, Kyushu University; December 1999; ISSN 0916-7315; Volume 20, No. 3, pp. 111-123; In Japanese; Copyright; Avail: Issuing Activity

In 1994 and 1996, A seismic refraction experiment was conducted on a 227km N-S seismic line in the eastern part or Kyushu, Japan, by Research Group for Explosion Seismology (RGES). Six explosion seismic sources, and 230 seismic stations were installed on the seismic line. We picked tip First arrivals of P-waves from seismograms. Firstly applying assumption of horizontal stratified model and method of difference, we obtained an initial velocity model. Secondly applying ray tracing method, we obtained the proposed velocity model of the upper crustal structure beneath the eastern part of Kyushu. The velocity model shows that the P-wave velocity of the upper most part in the basement layer is 5.8km/s along this seismic line. At Beppu-Shimabara Graben in the northern part of seismic line the sediment layer of 2.6km/s have 1-2km half graben structure. In the southern part

of seismic line, the sediment layer appears 10km thickness which is composed of three layers with 3.7,4.5, and 5.4km/s This area corresponds to Shimanto southern sub-belt in Wanizuka Mountain area.
Author
Earth Crust; P Waves; Seismology; Seismic Waves; Crustal Fractures; Geological Faults

20000025755 Kyushu Univ., Faculty of Science, Fukuoka, Japan
Development of 2D and 3D Codes of the Velocity-Stress Staggered-Grid Finite-Difference Method for Modelling Seismic Wave Propagation
Okamoto, Taro, Tokyo Inst. of Tech., Japan; Hayashida, Tomohiro; Takenaka, Hiroshi; Science Reports, Department of Earth and Planetary Sciences, Kyushu University; December 1999; ISSN 0916-7315; Volume 20, No. 3, pp. 99-110; In Japanese; Copyright; Avail: Issuing Activity

We have developed 2D and 3D finite-difference codes for modeling seismic wave propagation. These are based on the velocity-stress formulation of the elastodynamic equation, which is discretized by a staggered-grid scheme second-order accurate in time and second- or fourth-order accurate in space. In this article we describe the outline of the codes and boundary conditions we employed. We developed a free Surface condition for 3D finite-difference scheme, which is an extension of a free surface condition for 2.5D Finite-difference scheme developed by OKAMOTO(1994). We also present some numerical examples for demonstrating the accuracy of our codes.
Author
Two Dimensional Models; Three Dimensional Models; Computational Grids; Finite Difference Theory; Seismic Waves; Wave Propagation

20000025756 Kyushu Univ., Faculty of Science, Fukuoka, Japan
Seismograph Orientation at K-NET Observatories, 1, Western Kagoshima
Fujiwara, Hiroyuki, National Research Inst. for Earth Science and Disaster Prevention, Japan; Takenaka, Hiroshi; Watanabe, Atsushi; Fujii, Yushiro; Nagano, Hajime; Science Reports, Department of Earth and Planetary Sciences, Kyushu University; December 1999; ISSN 0916-7315; Volume 20, No. 3, pp. 89-97; In Japanese; Copyright; Avail: Issuing Activity

Orientation of seismometers at 12 observatories of the K-NET in western Kagoshima region (KGS001 - KGS012) was measured in this study. We found that stations KGS006 and KCS009 have rather large misorientation greater than 15 deg. We quickly check the effects of such instrument misorientation on waveform using the records of the 1997 northwestern Kagoshima earthquakes.
Author
Seismographs; Alignment; Misalignment

20000025793 Kyushu Univ., Faculty of Science, Fukuoka, Japan
Broadband Strong-Motion Observation on the Hard Rock Site at Kushikino
Watanabe, Atsushi; Fujii, Yushiro; Futamure, Hayato; Kame, Nobuki; Takenaka, Hiroshi; Skuzuki, Sadaomi; Uehira, Kenji; Matsushima, Takeshi; Science Reports, Department of Earth and Planetary Sciences, Kyushu University; December 1999; ISSN 0916-7315; Volume 20, No. 3, pp. 79-88; In Japanese; Copyright; Avail: Issuing Activity

In 1997, two moderate earthquakes occurred in the northwestern part of Kagoshima Prefecture (MJMA 6.5 on March 26 and MJMA 6.3 on May 13), and a large number of aftershocks occurred in the southern part of the second event focal region. We started the observation of the aftershocks from April 1, 1998, at Kushikino. We used a broadband strong-motion velocity-type seismograph and in accelerograph in order to record the full NN,aN,eforms of the strong ground motions. Up to April 25, 1999, we observed 74 events, and 3 events were recorded by both seismographs. In this paper, we report the detail of observational conditions and show some waveforms we obtained.
Author
Earthquakes; Seismology; Seismic Waves; Shock Waves

20000026927 SRI International Corp., Menlo Park, CA USA
Observations and Simulations of the M-I Coupling of Bursty Convection
Sanchez, Ennio R., SRI International Corp., USA; Feb. 28, 2000; 9p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG5-8111; SRI Proj. P10055; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The aim of the project is to establish how much of the magnetotail's total potential is due to flow bursts and how much of this potential maps to the ionosphere. In order to quantify these contributions, we need to develop a reliable method to measure

the total cross-polar cap potential and the total reconnection rate across the entire polar cap boundary. This was the goal achieved in the first year of the grant. In the following section, we describe in more detail the activities leading to this goal.
Derived from text
Geomagnetic Tail; Planetary Magnetotails; Magnetic Islands; Magnetic Field Reconnection; Magnetic Fields

47
METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification

20000025318 NASA Goddard Space Flight Center, Greenbelt, MD USA
Tropical Rainfall Measuring Mission
December 1999; 4p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Tropical rainfall affects the lives and economics of a majority of the Earth's population. Tropical rain systems, such as hurricanes, typhoons, and monsoons, are crucial to sustaining the livelihoods of those living in the tropics. Excess rainfall can cause floods and great property and crop damage, whereas too little rainfall can cause drought and crop failure. The latent heat release during the process of precipitation is a major source of energy that drives the atmospheric circulation. This latent heat can intensify weather systems, affecting weather thousands of kilometers away, thus making tropical rainfall an important indicator of atmospheric circulation and short-term climate change. Tropical forests and the underlying soils are major sources of many of the atmosphere's trace constituents. Together, the forests and the atmosphere act as a water-energy regulating system. Most of the rainfall is returned to the atmosphere through evaporation and transpiration, and the atmospheric trace constituents take part in the recycling process. Hence, the hydrological cycle provides a direct link between tropical rainfall and the global cycles of carbon, nitrogen, and sulfur, all important trace materials for the Earth's system. Because rainfall is such an important component in the interactions between the ocean, atmosphere, land, and the biosphere, accurate measurements of rainfall are crucial to understanding the workings of the Earth-atmosphere system. The large spatial and temporal variability of rainfall systems, however, poses a major challenge to estimating global rainfall. So far, there has been a lack of rain gauge networks, especially over the oceans, which points to satellite measurement as the only means by which global observation of rainfall can be made. The Tropical Rainfall Measuring Mission (TRMM), jointly sponsored by the National Aeronautics and Space Administration (NASA) of the USA and the National Space Development Agency (NASDA) of Japan, provides visible, infrared, and microwave observations of tropical and subtropical rain systems.The satellite observations are complemented by ground radar and rain gauge measurements to validate satellite rain estimation techniques. Goddard Space Flight Center's involvement includes the observatory, four instruments, integration and testing of the observatory, data processing and distribution, and satellite operations. TRMM has a design lifetime of three years. Data generated from TRMM and archived at the GDAAC are useful not only for hydrologists, atmospheric scientists, and climatologists, but also for the health community studying infectious diseases, the ocean research community, and the agricultural community.
Author
Tropical Regions; Rain; Hurricanes; Monsoons; Typhoons; Trmm Satellite; Atmospheric Circulation; Latent Heat; Weather

20000025439 NASA Marshall Space Flight Center, Huntsville, AL USA
A Low Precipitation Supercell over the Southeast US: A Case Study
Robert, Barry C., NASA Marshall Space Flight Center, USA; Knupp, Kevin R., Alabama Univ., USA; Buechler, Dennis, Alabama Univ., USA; [1998]; 1p; In English; 19th; Severe Local Storms, 14-18 Sep. 1998, Minneapolis, MD, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

On 28 March 1997 a low precipitation supercell storm was observed 125 km east of Memphis, TN. The storm exhibited a visual appearance similar to that of Great Plains low precipitation (LP) supercells while it was being video typed for 35 min. beginning at 2335 UTC. While the storm produced hailstones up to 4.5 cm in diameter, and had a 4 hour lifetime, tornadoes were absent. However, over 20 tornadoes were produced in Kentucky and Tennessee (TN) by other thunderstorms during that afternoon and evening. The purpose of this paper is to document this LP supercell that occurred in the Southeastern US. to the authors' knowledge an LP storm has not yet been documented in the Southeastern US. This paper presents a detailed overview of the LP supercell, including synoptic conditions, radar observations, lightning data and visual observations of the storm.
Author
Visual Observation; Hail; Thunderstorms; Radar Tracking

20000025443 NASA Marshall Space Flight Center, Huntsville, AL USA

Survey of the Polar Wind near 1 and 8Re with POLAR

Horwitz, J. L., NASA Marshall Space Flight Center, USA; Su, Y. J., NASA Marshall Space Flight Center, USA; Moore, Thomas E., NASA Marshall Space Flight Center, USA; Giles, Barbara L., NASA Marshall Space Flight Center, USA; Craven, Paul D., NASA Marshall Space Flight Center, USA; Chandler, Michael O., NASA Marshall Space Flight Center, USA; Hirahara, M., NASA Marshall Space Flight Center, USA; Pollock, Craig J., NASA Marshall Space Flight Center, USA; [1998]; 1p; In English; Cambridge Symposium, 3 Jul. 1998, Lisbon, Portugal; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Recent theoretical/modeling developments as well as measurements by Akebono and other spacecraft have created renewed interest in the polar wind. This interest arises generally from two principal aspects: (a) Understanding the physics of such plausible influences as photo-electron-driven parallel electric fields and convection-driven centrifugal acceleration on the polar wind transport; and (b) Understanding the intermediate fate of the polar wind--in particular, its contribution to the plasma content of such magnetospheric domains as the plasma sheet and tail lobes. In this talk, we will describe the results of a new survey of the intermediate(lR(sub E)) and high(8 R(sub E)) polar wind, based on high-resolution core ion measurements with the Thermal Ion Dynamics Experiment(TIDE) on POLAR. These new measurements of H(+), He(+), and O(+) densities, parallel flow velocities, Mach numbers and fluxes, and parallel and perpendicular temperatures, will be used to explore such issues as: (1) Supersonic vs. subsonic polar wind flows; (2) Upward and downward O(+) flows, and the origin of the polar cap ions; (3) Parallel flow speeds for various polar wind ion species in the context of various acceleration/transport mechanisms; and (4) Relationships of polar wind bulk parameters to solar zenith angle and to magnetospheric day-night distance, and their implications for the origin and transport of the polar wind.

Author

Numerical Analysis; Mathematical Models; Polar Meteorology; Wind (Meteorology); Convection; Surveys

20000025452 Wyoming Univ., Dept. of Atmospheric Science, Laramie, WY USA

Properties of PSCs and Cirrus Determined from AVHRR Data

Hervig, Mark, Wyoming Univ., USA; Pagan, Kathy, San Francisco State Univ., USA; Foschi, Patricia G., San Francisco State Univ., USA; [1999]; 24p; In English

Contract(s)/Grant(s): NAG5-6628; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Polar stratospheric clouds (PSCS) and cirrus have been investigated using thermal emission measurements at 10.8 and 12 micrometers wavelength (channels 4 and 5) from the Advanced Very High Resolution Radiometer (AVHRR). The AVHRR signal was evaluated from a theoretical basis to understand the emission from clear and cloudy skies, and models were developed to simulate the AVHRR signal. Signal simulations revealed that nitric acid PSCs are invisible to AVHRR, while ice PSCs and cirrus are readily detectable. Methods were developed to retrieve cloud optical depths, average temperatures, average effective radii, and ice water paths, from AVHRR channels 4 and 5. Properties of ice PSCs retrieved from AVHRR were compared to values derived from coincident radiosondes and from the Polar Ozone and Aerosol Measurement II instrument, showing good agreement.

Author

Advanced Very High Resolution Radiometer; Stratosphere; Ice Clouds; Optical Properties; Cirrus Clouds; Thermal Emission

20000027505 NASA Goddard Space Flight Center, Greenbelt, MD USA

A Comparison of the Diurnal Variation of Rainfall in the LBA Area Derived from Satellite Infrared Observations and Raingages

Negri, Andrew J., NASA Goddard Space Flight Center, USA; Xu, L., Arizona Univ., USA; Adler, R. F., NASA Goddard Space Flight Center, USA; Rickenbach, T. M., NASA Goddard Space Flight Center, USA; [1999]; 1p; In English; Data Analysis Workshop on the WETAMC/LBA and TRMM/LBA, 8-9 Nov. 1999, Sao Paulo, Brazil; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

In this paper we will present results from the application of a satellite infrared (IR) technique for estimating rainfall over northern South America. Our main objectives are to examine the diurnal variability of rainfall and to investigate the relative contributions from the convective and stratiform components. Estimates for Jan-Apr. 1999 will be presented for a large(30 by 50 degree) area that includes the Amazon Basin and the Large-Scale Biosphere-Atmosphere (LBA) study area. An analysis of the LBA raingage has begun, and results from the analysis of the gage-derived diurnal cycle will be compared to the satellite estimates. See the attached figure for preliminary results. Also, we hope to perform a comparison of results with LBA case studies of

mesoscale convective systems using TOGA and S-bands radars. Future calibration of the IR technique using rain estimates from Tropical Rainfall Measuring Mission (TRMM) is anticipated.
Author
Estimates; Rain; Satellite Observation; Diurnal Variations; Earth Observations (From Space)

20000027510 NASA Goddard Space Flight Center, Greenbelt, MD USA
ER-2 Observations of Precipitation Systems During TRMM-LBA
Heymsfield, Gerald, NASA Goddard Space Flight Center, USA; Tian, Lin, Universities Space Research Association, USA; Geerts, Bart, Science Systems and Applications, Inc., USA; [1999]; 1p; In English; Data Analysis Workshop on the WETAMC/LBA and TRMM/LBA, 8-9 Nov. 1999, Sao Paulo, Brazil; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The NASA ER-2 performed numerous flights over precipitation systems in Rondonia, Brazil. The ER-2 carried a payload including the ER-2 Doppler Radar (EDOP), the Advanced Microwave Precipitation Radiometer (AMPR), the Lightning Instrument Package, and other instruments. This presentation will overview the types of data sets collected during TRMM-LBA with particular emphasis on EDOP measurements. Numerous cases of convection ranging from weak to very intense, were overflown by the ER-2. Two TRMM overpasses were coincident with ER-2 flights which allowed for intercomparisons between the Precipitation Radiometer (PR), EDOP, and the S-POL and TOGA ground-based radars. Preliminary results from this comparison will be presented as well as initial selection of case studies and efforts involving vertical motions in convection.
Author
Convection; Doppler Radar; Precipitation; Atmospheric Circulation; Radar Data

20000027511 NASA Goddard Space Flight Center, Greenbelt, MD USA
Improving Global Reanalyses and Short-Range Forecast Using TRMM and SSM/I-Derived Precipitation and Moisture Observations
Hou, Arthur Y., NASA Goddard Space Flight Center, USA; Zhang, Sara Q., NASA Goddard Space Flight Center, USA; daSilva, Arlindo M., NASA Goddard Space Flight Center, USA; [1999]; 1p; In English; Meteorological Satellite Data Users', 29 May - 2 Jun. 2000, Bologna, Italy; Sponsored by European Organization for the Exploitation of Meteorological Satellites, Unknown; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Global reanalyses currently contain significant errors in the primary fields of the hydrological cycle such as precipitation, evaporation, moisture, and the related cloud fields, especially in the tropics. The Data Assimilation Office (DAO) at the NASA Goddard Space Flight Center has been exploring the use of tropical rainfall and total precipitable water (TPW) observations from the TRMM Microwave Imager (TMI) and the Special Sensor Microwave/ Imager (SSM/I) instruments to improve short-range forecast and reanalyses. We describe a 1+1D procedure for assimilating 6-hr averaged rainfall and TPW in the Goddard Earth Observing System (GEOS) Data Assimilation System (DAS). The algorithm is based on a 6-hr time integration of a column version of the GEOS DAS, hence the 1+1D designation. The scheme minimizes the least-square differences between the observed TPW and rain rates and those produced by the column model over the 6-hr analysis window. This 1+1D scheme, in its generalization to four dimensions, is related to the standard 4D variational assimilation but uses analysis increments instead of the initial condition as the control variable. Results show that assimilating the TMI and SSW rainfall and TPW observations improves not only the precipitation and moisture fields but also key climate parameters such as clouds, the radiation, the upper-tropospheric moisture, and the large-scale circulation in the tropics. In particular, assimilating these data reduce the state-dependent systematic errors in the assimilated products. The improved analysis also provides better initial conditions for short-range forecasts, but the improvements in forecast are less than improvements in the time-averaged assimilation fields, indicating that using these data types is effective in correcting biases and other errors of the forecast model in data assimilation.
Author
Algorithms; Cloud Cover; Moisture; Rain; Remote Sensing; Systematic Errors; Troposphere; Water Vapor; Moisture Content

20000027558 NASA Goddard Space Flight Center, Greenbelt, MD USA
Choosing Meteorological Input for the Global Modeling Initiative Assessment of High Speed Aircraft
Douglass, A. R., NASA Goddard Space Flight Center, USA; Prather, M. P., NASA Goddard Space Flight Center, USA; Hall, T. M., NASA Goddard Space Flight Center, USA; Strahan, S. E., NASA Goddard Space Flight Center, USA; Raesch, P. J., NASA Goddard Space Flight Center, USA; Sparling, L. C., NASA Goddard Space Flight Center, USA; Coy, Lawrence, NASA Goddard Space Flight Center, USA; Rodriquez, J. M., NASA Goddard Space Flight Center, USA; 1999; In English; GRIPS Workshop, 22-25 Mar. 1999, Reading, UK; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

The Global Modeling Initiative (GMI) science team is developing a three dimensional chemistry and transport model (CTM) to be used in assessment of the atmospheric effects of aviation. Requirements are that this model be documented be validated against observations, use a realistic atmospheric circulation, and contain numerical transport and photochemical modules representing atmospheric processes. The model must also retain computational efficiency to be tractable to use for multiple scenarios and sensitivity studies. to meet these requirements, a facility model concept was developed in which the different components of the CTM are evaluated separately. The first use of the GMI model will be to evaluate the impact of the exhaust of supersonic aircraft on the stratosphere. The assessment calculations will depend strongly on the wind and temperature fields used by the CTM. Three meteorological data sets for the stratosphere are available to GMI: the National Center for Atmospheric Research Community Climate Model (CCM2), the Goddard Earth Observing System Data Assimilation System (GEOS DAS), and the Goddard Institute for Space Studies general circulation model (GISS). Objective criteria were established by the GMI team to identify the data set which provides the best representation of the stratosphere. Simulations of gases with simple chemical control were chosen to test various aspects of model transport. The three meteorological data sets were evaluated and graded based on their ability to simulate these aspects of stratospheric measurements. This paper describes the criteria used in grading the meteorological fields. The meteorological data set which has the highest score and therefore was selected for GMI is CCM2. This type of objective model evaluation establishes a physical basis for interpretation of differences between models and observations. Further, the method provides a quantitative basis for defining model errors, for discriminating between different models, and for ready re-evaluation of improved models. These in turn will lead to a higher level of confidence in assessment calculations.
Author

Atmospheric Circulation; Atmospheric General Circulation Models; Climate Models; Data Systems; Meteorological Parameters; Temperature Distribution; Rapid Transit Systems

20000027559 Maryland Univ., Dept.of Meteorology, College Park, MD USA

A Variable Resolution Stretched Grid Data Assimilation System for Regional Studies and Applications

Fox–Rabinovitz, Michael S., Maryland Univ., USA; Takacs, Lawrence L., General Sciences Corp., USA; Dee, Dick P., General Sciences Corp., USA; 19990424; In English; EGS 24th General Assembly, 18-24 Apr. 1999, The Hague, Netherlands; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

The variable resolution stretched grid (SG) version of the Goddard Earth Observing System (GEOS) Data Assimilation System (DAS) incorporating the GEOS SG-GCM, has been developed and tested. The area/region of interest used in experiments is a rectangle over the U.S. with -60 km horizontal resolution and 70 layers extending from the surface to 0.1 hPa. The forecast error statistics has been reassessed for finer regional resolution. The experiments are performed for winter and summer seasons. The SG-GCM and SG-DAS experiments show that a definite down-scaling takes place over the area of interest. The SG-DAS is capable of reproducing regional mesoscale patterns and diagnostics that are not produced by coarser uniform resolution runs. The SG-DAS fields and diagnostics are used for regional forecasting, new instrument impact studies, and for validation of regional climate simulation experiments.
Author

Assimilation; Data Systems; Diagnosis; Forecasting; Simulation

20000027562 NASA Goddard Inst. for Space Studies, New York, NY USA

Statistics of Cirrus Horizontal Inhomogeneity in the Southern Great Plains

Smith, S. A., NASA Goddard Inst. for Space Studies, USA; DelGenio, Anthony D., Columbia Univ., USA; 1999; In English; ARM Science Team Meeting, 22-25 Mar. 1999, San Antonio, TX, USA; Sponsored by Department of Energy, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

Variability of cloud properties on scales smaller than that of a GCM grid is potentially important both for realistic parameterizations of microphysical processes and for the prediction of the large-scale radiative effects of clouds, have suggested that a simple model of marine stratocumulus variability, based on the assumption of Gaussian variation statistics of cloud depth, can explain the liquid water path histogram shapes observed in LANDSAT data. In advance of ARM SGP MMCR ice water path climatologies, we have examined aircraft ice water content statistics for cirrus clouds observed over Coffeyville, Kansas during FIRE 2. We find similar associations of histogram shape and cloud cover for these clouds, and we show that a simple modification of the model for cirrus combined with observed mean cloud depths, their standard deviations, and ambient thermodynamic conditions predicts both the histogram shape and cirrus cloud cover fairly well. This suggests that subgrid variability of cloud

properties may be similar for vastly different cloud types, and that a universal parameterization of the effects of subgrid variability in GCMs as a function of only a few parameters may be a realistic goal.
Author
Cloud Physics; Climatology; Cirrus Clouds; Great Plains Corridor (North America); Inhomogeneity; Standard Deviation; Stratocumulus Clouds

20000027563 NASA Goddard Inst. for Space Studies, New York, NY USA
Dependence of Cumulus Anvil Radiative Properties on Environmental Conditions in the Tropical West Pacific
Ye, B., NASA Goddard Inst. for Space Studies, USA; DelGenio, A. D., Columbia Univ., USA; 1999; In English; ARM Science Team Meeting, 22-25 Mar. 1999, San Antonio, TX, USA; Sponsored by Department of Energy, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

Areally extensive, optically thick anvil clouds associated with mesoscale convective clusters dominate the shortwave cloud forcing in the tropics and provide longwave forcing comparable to that of thin cirrus. Changes in the cover and optical thickness of tropical anvils as climate warms can regulate the sign of cloud feedback. As a prelude to the study of MMCR data from the ARM TWP sites, we analyze ISCCP-derived radiative characteristics of anvils observed in the tropical west Pacific during the TOGA-COARE IOP. Anvils with radius greater than 100 km were identified and tracked from inception to decay using the Machado-Rossow algorithm. Corresponding environmental conditions just prior to the start of the convectove event were diagnosed using the Lin-Johnson objective analysis product. Small clusters (100-200 km radius) are observed to have a broad range of optical thicknesses (10-50), while intermediate optical thickness clusters are observed to range in size from 100 km to almost 1000 km. Large-size clusters appear to be favored by strong pre-storm large scale upward motion throughout the troposphere, moist low-to-midlevel relative humidities, environments with slightly higher CAPE than those for smaller clusters, and strong front-to-rear flow. Optically thick anvils are favored in situations of strong low-level moisture convergence and strong upper-level shear.
Author
Algorithms; Anvil Clouds; Feedback; Pacific Ocean; Troposphere; Radiative Lifetime; Environmental Chemistry

20000027564 NASA Goddard Inst. for Space Studies, New York, NY USA
Multi-Spectral Cloud Property Retrieval
Carlson, Barbara E., NASA Goddard Inst. for Space Studies, USA; Lynch, R, Atmospheric and Environmental Research, Inc., USA; 1999; In English; ARM Science Team Meeting, 22-25 Mar. 1999, San Antonio, TX, USA; Sponsored by Department of Energy, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

Despite numerous studies to retrieve cloud properties using infrared measurements the information content of the data has not yet been fully exploited. In an effort to more fully utilize the information content of infrared measurements, we have developed a multi-spectral technique for retrieving effective cloud particle size, optical depth and effective cloud temperature. While applicable to all cloud types, we begin by validating our retrieval technique through analysis of MS spectral radiances obtained during the SUCCESS field campaign over the ARM SGP CART facility, and compare our retrieval product with lidar and MODIS Airborne Simulator (MAS) measurement results. The technique is then applied to the Nimbus-4 MS infrared spectral measurements to obtain global cloud information.
Author
Cloud Physics; Imaging Spectrometers; Information; Spectrum Analysis; Research

20000027565 NASA Goddard Inst. for Space Studies, New York, NY USA
Modeling of Sub-Grid Heterogeneity and its Impact on GCM Global Radiation Balance
Lacis, Andrew, NASA Goddard Inst. for Space Studies, USA; Cairns, B., NASA Goddard Inst. for Space Studies, USA; Rossow, W. B., Columbia Univ., USA; 1999; In English; ARM Science Team, 22-25 Mar. 1999, San Antonio, TX, USA; Sponsored by Department of Energy, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

The spatial and temporal variability of high, low, and mid-level clouds is obtained from ISCCP D1 data. Monthly mean global maps of the observed cloud variability are used to re-scale GCM prognostic cloud optical depths and radiative parameters via the Monte Carlo cloud heterogeneity parameterization that utilizes the existing plane-parallel GCM radiative transfer model to compute radiative fluxes for inhomogeneous cloud distributions. The GCM radiative fluxes at TOA and the ground surface are then compared to ERBE and GEBA results. These comparisons show that including sub-grid cloud variability in the GCM radiative model improves agreement between the GCM radiative energy budget components and observations,
Author
Earth Radiation Budget Experiment; Heterogeneity; Models; Radiation Distribution

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OCEANOGRAPHY

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

20000025431 Science Applications International Corp., Raleigh, NC USA
DeSoto Canyon Eddy Intrusion Study. Annual Report: Year 3 ***Final Report, 1 Jul. 1998 - 30 Jun. 1999***
Sep. 1999; 24p; In English
Report No.(s): PB2000-102391; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Report documents activities and data collected during third year (July 1998 through June 1999) of the DeSoto Canyon Eddy intrusion Study. Study area encompasses area between 85.5 deg W to 89 deg W and 28.5 deg N to coast. Study activities are to (1) document and analyze by means of in-situ current measurements, hydrographic data, and satellite images the Loop Current intrusions and interactions with the northeastern Gulf of Mexico (NEGM) slope; (2) document and examine the dynamical processes of momentum, mass, and vertical vorticity exchanges that occur during Loop Current-slope interactions and other driving forces; (3) estimate the frequency of Loop Current and secondary eddy interactions with the NEGM slope, and conduct and assessment of the vertical and horizontal current shears, exchanges of vorticity, momentum, and mass fields associated with these eddy-slope interactions; and (4) elucidate the role of the Desoto Canyon in Loop Current and eddy interactions and as a route of mass and momentum exchange between the shelf and deep water of the NEGM.
NTIS
Canyons; Eddy Currents; Vorticity; Vortices; Hydrography; Time Series Analysis; Gulf of Mexico

20000025481 Massachusetts Inst. of Tech., Lab. of Electronics, Cambridge, MA USA
Polarimetric Passive Remote Sensing of Ocean Surface ***Final Report, 15 Apr. - 30 Sep. 1998***
Kong, Jin–Au; Jan. 18, 2000; 48p; In English
Contract(s)/Grant(s): N00014-98-1-0643
Report No.(s): AD-A372480; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In the microwave remote sensing of ocean surface, the use of polarimetric passive techniques has shown potential for enhancing the retrieval of wind speed and directions. Recent theoretical and experimental research activities have concentrated on studies of polarimetric thermal emissions regarding the anisotropic ocean surface assuming a smoothly varying surface profile. However, under high wind conditions, the presence of breaking water waves, foam patches and bubbles will affect the polarimetric brightness temperatures of the plain ocean surface. The significance of foam on the ocean surface was recognized a long time ago, and several subsequent experiments performed have verified its importance. Previous studies of the foam contribution to the emissivity of ocean surface were based on empirical formulations derived from experimental data. Although several attempts at theoretically modeling the foam have been presented, it is difficult to incorporate them with rough ocean surface. The more realistic modeling for foam-covered ocean surface has been proposed by Huang et al., who consider the sea foam to be a layer with water particles over a rough sea surface. However, it is not suited to model the sea foam as the layer of spherical water particles, since the sea foam is dominated by water bubbles. In this chapter, we present the theoretical study on the polarimetric thermal emissions from foam-covered ocean surface based on a composite volume and rough surface scattering model using the radiative transfer theory. We model the locally foam-covered ocean surface as a random layer with water bubbles. The small perturbation method (SPM) is used for random rough ocean surface, where the bistatic scattering is calculated up to the second order. The radiative transfer equations for foam layer are solved using an iterative technique. The model predictions are compared with measurement data.
DTIC
Polarimetry; Remote Sensing; Ocean Surface; Microwave Imagery; Thermal Emission

20000025551 Naval Research Lab., Bay Saint Louis, MS USA
Navy Altimeter Data Requirements ***Final Report***
Jacobs, Gregg A.; Barron, Charlie N.; Carnes, Michael R.; Fox, Daniel N.; Hurlburt, Harley E.; Nov. 10, 1999; 24p; In English
Report No.(s): AD-A371871; NRL/FR/7320--99-9696; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Navy requirements for altimeter data are driven mainly by the operational systems for mesoscale ocean circulation monitoring and acoustic prediction. Specification of requirements also considers development toward future systems that will provide tidal height and currents, regional circulation in semienclosed basins, and wave heights. We provide a short synopsis of present systems for describing the ocean environment based on altimeter data. Typical mesoscale time and length scales, determined from historical altimeter data, guide the specification of time and space resolution requirements for future altimeter

systems. Accuracy requirements are based on the propagation of sea surface height errors into environmental estimates of the three-dimensional temperature and salinity fields and effects on sonar performance.
DTIC
Altimeters; Marine Environments; Oceanography

20000026830 Norwegian Defence Research Establishment, Kjeller, Norway
Bias Error in Acoustic Direction, Bearing Finding, Due to Reflections from Parallel Crest Sea Surface Waves, and Bias Error Compensation
Heimdal, P., Norwegian Defence Research Establishment, Norway; 1999; 206p; In English
Report No.(s): PB2000-102583; FFI-PUB-99/03099; No Copyright; Avail: CASI; A03, Microfiche; A10, Hardcopy

In passive acoustic direction, bearing measurements, errors due to reflections from the sea surface, can occur both in terms of fluctuations and bias error, the latter for parallel crest sea surface waves. The task is to relate bias error to parameters for the sea surface waves, to frequency, and to position parameters for the target and own vessel, the latter a submarine. By such a relation, bearing bias error compensation can be obtained. A 3-dimensional treatment is needed for this. As preparation for this treatment, and for judgments on error variations, a large amount of 2-dimensional treatment is needed. Types of, and effects of water particle movements on rays and Doppler shift and spread, of regular and random sea surface wave ripple on strength of reflections, and for low grazing angles, of acoustic shadow zones and air bubbles, are treated. Bearing bias error compensation, with acceptable belief, is within a fraction of 1 degree.
NTIS
Acoustic Measurement; Bearing (Direction); Direction Finding; Bias; Ocean Surface; Surface Waves; Error Analysis

20000026832 Helsinki Univ. of Technology, Espoo, Finland
Proceedings of the 15th International Conference on Port and Ocean Engineering under Arctic Conditions
Tuhkuri, J.; Riska, K.; Aug. 1999; 470p; In English; 15th, 23-27 aUG. 1999, Espoo, Finland
Report No.(s): PB2000-102536; Copyright; Avail: Issuing Activity

Proceedings of the 15th International Conference on Port and Ocean Engineering under Arctic Conditions are presented. Technological areas discussed include: Monitoring and observations of the formation of a first-year ice ridge-field; The ductile behavior of damaged ice under compression; A granular sea ice model; Parametric excitation of flexural-gravity edge waves in the vicinity of ice crack; The use of satellite information for ice navigation support; Monitoring ice conditions in the Arctic shelf zone with helicopter side looking radar; Electromagnetic sounding of sea ice thickness and a concept for the remote estimate of its strength; Video/laser helicopter sensor to collect pack ice properties for validation of RADARSAT SAR backscatter values; Analysis of concurrent SAR images and submarine ice draft profiles in the Arctic Ocean; and Ice pressure on a bridge pier during river break-up.
NTIS
Conferences; Arctic Regions; Sea Ice; Ports; Marine Technology; Arctic Ocean

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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.

20000025542 Idaho Univ., Moscow, ID USA
Development of Sensory Receptors in Skeletal Muscle *Final Report*
DeSantis, Mark, Idaho Univ., USA; [2000]; 10p; In English
Contract(s)/Grant(s): NCC2-862; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The two major goals for this project is to (1) examine the hindlimb walking pattern of offspring from the Flight dams as compared with offspring of the ground control groups from initiation of walking up to two months thereafter; and (2) examine skeletal muscle.
CASI
Muscles; Musculoskeletal System; Sensory Perception; Receptors (Physiology); Sense Organs; Central Nervous System

20000025562 Institute of Space Medico-Engineering, Beijing, China

Effects of 2450 MHz Microwave Irradiation of Different Duration on Central Transmitters in Mice

Chen, Jian, Institute of Space Medico-Engineering, China; Yang, Yu–Hua, Institute of Space Medico-Engineering, China; Jiang, Rui, Institute of Space Medico-Engineering, China; Pu, Jing–Sui, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Jun. 1999; ISSN 1002-0837; Volume 12, No. 3, pp. 220-222; In Chinese

Report No.(s): CN-11-2774/R; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The objective is to investigate the mechanism of effects of microwave irradiation on central nervous system (CNS). 72 male LACA mice were irradiated with 2450 MHz microwave for 2,7 or 14 days respectively with the same total incident power density of 5 mW/sq cm. After exposure, every group showed an increase of monoaminoxidase (MAO) in the cerebral cortex as compared with the control (P is less than 0.001). The norepinephrine (NE) content were significantly reduced after two-day or two-week exposure(P is less than 0. 05). The 5-hydroxyindoleacetic acid (5-HIAA) content, the main metabolite of 5-hydroxytryptamine (5-HT), were significantly increased after two-day or 7 day exposure (P is less than 0.001). The metabolic abnormity of neurotransmitters in the central nervous system may be one of the factors causing disorders in the microwave operators.

Author

Irradiation; Microwaves; Neurotransmitters

20000025563 Institute of Space Medico-Engineering, Beijing, China

Effect of Short Time High-Intensity Noise on Hearing Organ in Guinea Pigs

He, Yan–Jun, Institute of Space Medico-Engineering, China; Li, Dao–De, Institute of Space Medico-Engineering, China; Zheng, Su–Xian, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Jun. 1999; ISSN 1002-0837; Volume 12, No. 3, pp. 217-219; In Chinese

Report No.(s): CN-11-2774/R; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The objective is to investigate the effects of high-intensity noise on hearing organ. 24 guinea pigs were randomly divided into three groups (8 each): normal control group, 115 dB(A) noise exposure group and 118 dB (A) noise exposure group. Changes of eardrum, hair cell and hearing threshold were observed in guinea pigs after 3 minute exposure to 115 dB(A) and 118 dB(A) pinknoise level. The result is: (1) No obvious damage of eardrum was found in both two noise exposure groups with otoscopy; but obvious temporary threshold shift (TTS) of hearing was observed in both groups; (2) Significant damage of hair cell was observed in both exposure groups by morphological analysis of the cochlea (P is less than 0.01); (3) TTS in both exposure groups didn't recover to the pre-experiment level within half an hour; (4) TTS and damage of hair cell were more severe in 118 dB(A) noise-exposure group than those in 115 dB(A) group (P is less than 0.05). Short time 115 dB(A) noise exposure can cause damage on hearing organ.

Author

Noise Intensity; Time Dependence; Hearing; Noise (Sound); Organs

20000025564 Institute of Aviation Medicine, Beijing, China

Cardiovascular Response to High Sustained +Gz Stress in Dogs

Shi, Lu–Jiang, Institute of Aviation Medicine, China; Zhang, Hong–Jin, Institute of Aviation Medicine, China; Tang, Wei–Ping, Institute of Aviation Medicine, China; Li, Guang–Dao, Institute of Aviation Medicine, China; Tan, Cheng, Institute of Aviation Medicine, China; Song, Lei, Institute of Aviation Medicine, China; Space Medicine and Medical Engineering; Jun. 1999; ISSN 1002-0837; Volume 12, No. 3, pp. 214-216; In Chinese

Report No.(s): CN-11-2774/R; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In this report we investigate features of electrocardiography (ECG) and arterial pressure in dog during and after +Gz stress. Six anesthetized dogs were catheterized for the measurement of ascending aortic pressure (AP) and common iliac arterial pressure (CIAP). A lead of ECG was monitored continuously. Then, dogs were placed supine in rotatable platform on one arm of an 1.7 m radius centrifuge. The animals were exposed serially to acceleration profiles of up to +7 Gz, consisting of a slow onset to peak acceleration, 90 s peak G, and a rapid decline back to control. A recovery time of at least 20 min was allowed after each acceleration profile. The results are: (1) The amplitude of P-wave was influenced by the magnitude of the acceleration (2.3 +/- 0.2 mV at rest vs. 4.5 +/- 0.5 mV at +3 Gz, 4.8 +/- 0.3 mV at +5 Gz and 5.3 +/- 0.7 mV at +7 Gz, respectively P is less than 0.05); (2) It appeared that arteria mean pressure increased and pulse pressure decreased in CIAP during high +Gz stress; (3) AP increased greatly after +Gz stress(17.29 +/- 5.59/11.31 +/- 3.86 kPa at rest vs. 27.53 +/- 6.12/20. 62 +/- 1.86 kPa 30s after +7 Gz P is less than 0.01). We conclude that (1) The change of the amplitude of P-wave reflected the atrial displacement which may be the reason of arrhythmia;

(2)The perfusion pressure is an important physiological parameter to the cardiovascular dysfunction during high +Gz stress; (3) Greatly higher AP after +Gz stress could be a feature of vascular exhaustion.
Author
Physiological Responses; Acceleration Stresses (Physiology); Electrocardiography; Pressure Measurement; Heart Function; Arteries

20000025572 Fourth Military Medical Univ., Dept. of Aerospace Physiology, Xi'an, China
Changes in Lumen Diameters of Vessels in Arteriolar Network in Rat Soleus Muscle After Simulated Weightlessness
Mao, Qin–Wen, Fourth Military Medical Univ., China; Zhang, Li–Fan, Fourth Military Medical Univ., China; Ma, Jin, Fourth Military Medical Univ., China; Space Medicine and Medical Engineering; Jun. 1999; ISSN 1002-0837; Volume 12, No. 3, pp. 177-180; In Chinese
Report No.(s): CN-11-2774/R; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The objective is to elucidate whether simulated weightlessness can induce changes in lumen diameters of vessels in arteriolar networks in hindlimb muscles and whether these changes are reversible. Changes in lumen diameters of the vessels in the arteriolar network in soleus muscle of 4 wk tail-suspended (SUS-4), 1 wk (REC-1) and 5 wk (REC-5) recovered rats were examined and compared with that of control (CON) rats by use of the method of intra-arterial infusion of a carbon suspension. The lumen diameters of the feeding arteries and arcade arterioles, and the transverse arterioles of the order of both V and II in the SUS-4 group were reduced by 31%, 29%, 28%, and 41%, respectively, as compared with that of the CON group (P is less than 0.01). The diameters of these arterioles in REC-1 group were partially restored but remained significantly less than that of the CON group (P is less than 0.05, or P is less than 0.01). In REC-5 group, except for the transverse arterioles of order II, the diameters of all the other arterioles were fully recovered. These findings indicate that a 4 wk simulated weightlessness might induce atrophic changes in the arterioles of the hindlimb muscles. It also suggests that structural changes in arteriolar network might be an important mechanism accounting for postflight orthostatic intollerance.
Author
Weightlessness Simulation; Lumens; Arteries; Diameters; Musculoskeletal System

20000025574 Fourth Military Medical Univ., Dept. of Aerospace Physiology, Xi'an, China
Alterations of Arterial Vasoconstrictor Responsiveness in Rats During and After Tail-Suspension
Ma, Jin, Fourth Military Medical Univ., China; Zhang, Li–Fan, Fourth Military Medical Univ., China; Yang, Tian–De, Fourth Military Medical Univ., China; Zhang, Le–Ning, Fourth Military Medical Univ., China; Space Medicine and Medical Engineering; Jun. 1999; ISSN 1002-0837; Volume 12, No. 3, pp. 169-172; In Chinese
Report No.(s): CN-11-2774/R; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The objective is to characterize the time course of alterations in vasoconstrictor properties of arteries during simulated weightlessness, and to examine whether these alterations are reversible. The tail-suspended rat model was used to simulate weightlessness, and the alterations in vasoconstrictor response were examined in vitro using isolated arterial rings. Compared with that of controls, contractile tension evoked by KCI and phenylephrine (PE) were lower in abdominal aortic, mesenteric and femoral arterial rings from 2 wk tail-suspended rats (P is less than 0.05); after 4 wk tail-suspension, the responses of mesenteric and femoral arterial rings to KCI or PE were further decreased (P is less than 0.05); but contraction responses of arterial rings from 8 wk tail-suspended rats were similar to that of 4 wk simulated microgravity rats. The reversibility of altered arterial vasoreactivity after 4 wk tail-suspension was observed for 5 wk. Vasoreactivity of abdominal aortic rings was recovered after first week of recovery, but it took five weeks that altered vasoreactivity of mesenteric and femoral artery got back to normal. The alterations in constrictor properties of arteries are dependent on both the duration of tail-suspension and the position of artery, the diminished vasoconstrictor properties appear to reach a new steady state after 4 wk tail-suspension, and the changes are reversible.
Author
Arteries; Vasoconstriction; Revisions

20000026303 Wyle Labs., Inc., Life Sciences, Houston, TX USA
KC-135 and Other Microgravity Simulations
Noel, Skinner C., Wyle Labs., Inc., USA; August 1999; 163p; In English; See also 20000026304 through 20000026336; Original contains color illustrations
Contract(s)/Grant(s): NAS9-97005
Report No.(s): NASA/CR-1999-208922; NAS 1.26:208922; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This document represents a summary of medical and scientific evaluations conducted aboard the KC-135 from June 20, 1998 to June 20, 1999. Included is a general overview of KC-135 activities manifested and coordinated by the Life Sciences Research

Laboratories. A collection of brief reports that describes tests conducted aboard the KC-135 follows the overview. Principal investigators and test engineers contributed significantly to the content of the report describing their particular experiment or hardware evaluation. Although this document follows general guidelines, each report format may vary to accommodate differences in experiment design and procedures. This document concludes with an appendix that provides background information concerning the KC-135 and the Reduced-Gravity Program.
Author
C-135 Aircraft; Experiment Design; Life Sciences; Microgravity; Weightlessness Simulation; Parabolic Flight; Aerospace Medicine; Bioastronautics

20000026319 Texas Univ., Austin, TX USA
Undergraduate Program Flights: The Effects of Microgravity on Multidrug Resistance
Buchli, Jennifer, Texas Univ., USA; Afghanipour, Tony, Texas Univ., USA; Boone, John, Texas Univ., USA; Boyer, Darren, Texas Univ., USA; Dinh, Dustin, Texas Univ., USA; Hueske, Emily, Texas Univ., USA; John, Jeremy, Texas Univ., USA; Martin, Angela, Texas Univ., USA; Sanampudi, Jay, Texas Univ., USA; Piepmeier, Ed, Texas Univ., USA; KC-135 and Other Microgravity Simulations; August 1999, pp. 80-84; In English; See also 20000026303; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Response to drugs is predicated on transport mechanisms, expression, and activation of cellular receptors and enzymes. This mechanism of transverse migration of drugs across membranes is of fundamental importance to understanding drug delivery, because all drugs must cross membranes of one kind or another. The purpose of this experiment was to identify the effect that microgravity may have on multidrug resistance in leukocytes. Multidrug resistance (MDR) is the ability of a cell to withstand a broad spectrum of chemically related drugs following selection by only one drug. Studies conducted on MDR activity, because of its intrinsic complexity, provide insight into cellular function and drug action. The condition of microgravity was incorporated in developing a model to enhance our understanding of basic molecular mechanisms associated with drug action. The cytoskeleton is highly sensitive to changes in the microgravity environment. Cytoskeletal interactions with surface proteins are critical to the function of proteins as drug efflux pumps. The activities of surface proteins that are involved in MDR, such as the P-glycoprotein, are linked to membrane fluidity and the cytoskeleton. The experiment conducted was designed to analyze the cellular response associated with Doxorubicin activity in leukocytes under short-term weightlessness.
Derived from text
Drugs; Microgravity; Weightlessness; Cell Membranes (Biology); Aerospace Medicine; Pharmacology

20000026320 Vermont Univ., Burlington, VT USA
Undergraduate Program Flights: High Altitude Drosophila Science Experiment
Barnett, Dan, Vermont Univ., USA; Carroll, Megan, Vermont Univ., USA; Chung, Dan, Vermont Univ., USA; Nutting, Noel, Vermont Univ., USA; KC-135 and Other Microgravity Simulations; August 1999, pp. 85-88; In English; See also 20000026303; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Undergraduates of the University of Vermont (LTVM) are participating in NASA's Student Launch Program conducting biomedical science aboard a Nike-Orion sounding rocket. UVM was selected along with two other sounding projects from across the country. The UVM project--"Effects of a Sounding Rocket Flight on Drosophila"--is a biological experiment to confirm earlier findings that young male Drosophila fruit flies exposed to micro-gravity have an acceleration in their aging. The theory is that aging is the consequence of increased locomotion and the objective of the experiment is to measure the activities of the flies during the flight. Previous experiments have theorized that male Drosophila exposed to micro-gravity space flight have shortened life spans due to their increased motility and, in turn, their metabolic rates. Important advances in the understanding of the aging process, including humans, could be obtained through comprehending the changes experienced by the flies under these reduced gravity conditions. Increased motility is believed to be due to Drosophila's negative geotaxis response. A negative geotaxis response is an inherent trait of the Drosophila to move in the opposite direction of the Earth's gravitational vector when stimulated. This negative geotaxis response is primarily manifested as a walking response. This trait is present in nearly all Drosophila, although various levels of negative geotaxis are prevalent. Three Drosophila types with respect to negative geotaxis activity are to be evaluated: Normal vs. Hyperactive vs. Non. Within these different types, different characteristics will be taken into consideration: Males vs. Females as well as Young vs. Old. During the brief exposure to micro-gravity, the time course of the increased activity was examined as to whether the negative geotaxis response is the cause of the increased activity. Other parameters such as temperature and acceleration were measured to determine the exact conditions that the Drosophila experienced.
Derived from text
Drosophila; Gravitational Effects; Life Span; Microgravity; Aging (Biology); Gravitational Physiology; Bioastronautics

20000026324 Massachusetts Inst. of Tech., Cambridge, MA USA

Undergraduate Program Flights - NIMBLE: A Non-Invasive Microgravity Biomedical Life-Sciences Experiment

Carr, Christopher, Massachusetts Inst. of Tech., USA; Walker, Elizabeth, Massachusetts Inst. of Tech., USA; Pinson, David, Massachusetts Inst. of Tech., USA; KC-135 and Other Microgravity Simulations; August 1999, pp. 108-110; In English; See also 20000026303; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The objectives of this project are to verify the effects of micro- and hypergravity on the heart rate on humans to test the usability of the wearable computer-based bio-monitoring system. Passively collected pulse-oximetry and ECG data will be used to test the effects of micro-and hypergravity on the heart rate of humans. A workload task, which requires the flight crew to integrate information from the external and internal (on-screen) environments, will be used in conjunction with a subjective evaluation to test the hypothesis of system usability.

Derived from text

Gravitational Effects; Microgravity; Oximetry; Aerospace Medicine; Medical Equipment; Electrocardiography

20000026336 NASA Johnson Space Center, Houston, TX USA

Background Information About the KC-135 and the Reduced-Gravity Program

KC-135 and Other Microgravity Simulations; August 1999, pp. a-2; In English; See also 20000026303; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The Reduced-Gravity Program, operated by the NASA/Johnson Space Center (JSC), provides engineers, scientists, and astronauts alike, a unique opportunity to perform testing and training in a weightless environment but without ever having to leave the confines of the earth's orbit. Given the frequency of Space Shuttle missions and the anticipated construction and eventual habitation of the New International Space Station, the Reduced-Gravity Program provides a truly ideal environment to test and evaluate space hardware and experimental procedures prior to launch. The Reduced-Gravity Program was established in 1959 to investigate the reactions of humans and hardware during operations in a weightless environment. A specially modified KC-135 turbojet (KC-135A), flying parabolic arcs, produces periodic episodes of weightlessness lasting 20-25 secs. The KC-135 is sometimes also flown to provide short periods of lunar (1/6) and Martian (1/3) gravity.

Derived from text

C-135 Aircraft; Gravitation; Microgravity; Parabolic Flight; Weightlessness Simulation

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.

20000025505 NASA Johnson Space Center, Houston, TX USA

Microwave Treatment for Cardiac Arrhythmias

Arndt, G. Dickey, Inventor, NASA Johnson Space Center, USA; Carl, James R., Inventor, NASA Johnson Space Center, USA; Raffoul, George W., Inventor, NASA Johnson Space Center, USA; Pacifico, Antonio, Inventor, NASA Johnson Space Center, USA; May 18, 1999; In English

Patent Info.: Filed 17 Apr. 1996; NASA-Case-MSC-22483-1; US-Patent-5,904,709; US-Patent-Appl-SN-641045; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

Method and apparatus are provided for propagating microwave energy into heart tissues to produce a desired temperature profile therein at tissue depths sufficient for thermally ablating arrhythmogenic cardiac tissue to treat ventricular tachycardia and other arrhythmias while preventing excessive heating of surrounding tissues, organs, and blood. A wide bandwidth double-disk antenna is effective for this purpose over a bandwidth of about six gigahertz. A computer simulation provides initial screening capabilities for an antenna such as antenna, frequency, power level, and power application duration. The simulation also allows optimization of techniques for specific patients or conditions. In operation, microwave energy between about 1 Gigahertz and 12 Gigahertz is applied to monopole microwave radiator having a surface wave limiter. A test setup provides physical testing of microwave radiators to determine the temperature profile created in actual heart tissue or ersatz heart tissue. Saline solution pumped over the heart tissue with a peristaltic pump simulates blood flow. Optical temperature sensors disposed at various tissue

depths within the heart tissue detect the temperature profile without creating any electromagnetic interference. The method may be used to produce a desired temperature profile in other body tissues reachable by catheter such as tumors and the like.
Official Gazette of the U.S. Patent and Trademark Office
Arrhythmia; Heart; Heating; Medical Equipment; Microwaves

20000025539 Swedish Water and Air Pollution Research Lab., Stockholm, Sweden
Working Environment-LCA: Development of a Quantitative Method ***Arbetsmiljoe-LCA: Vidareutveckling av en Kvantitativ Metod***
Antonsson, A. B.; Nilsson, M.; Jan. 1999; 58p; In Swedish
Report No.(s): PB2000-102749; IVL-B-1320; No Copyright; Avail: National Technical Information Service (NTIS)

A method has previously been developed within IVL, to integrate working environment in the methodology for life cycle assessments, LCA. The case is a comparison of two alternatives, diesel and ethanol as fuel for bus driving. Data for the life cycle from a traditional LCA previously done for this case was used. The method developed is based on the collection of data for four impact categories, deaths due to work related accidents, workdays lost due to work related accidents and disease, hearing damages, and allergies and eczemas. The amount of work related accidents and diseases in the four impact categories in different parts of the life cycle has been calculated based on the amount of material/transports etc in each part of the life cycle in relation to the total amount produced in the branch. to control if the amount of injuries and diseases in any part of the life cycle deviates from a value calculated from average statistics on injuries and diseases in Sweden, a normalisation has been made for each of the four impact categories. In addition, a sensitivity analysis has been made to control how sensitive the result is to uncertainties in the statistics.
NTIS
Quantitative Analysis; Occupation; Aerospace Medicine

20000025559 Institute of Space Medico-Engineering, Beijing, China
Ocular Counterrolling as an Indicator of Vestibular Otolith Function
Wang, Lin–Jie, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Jun. 1999; ISSN 1002-0837; Volume 12, No. 3, pp. 231-234; In Chinese
Report No.(s): CN-11-2774/R; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Space Motion Sickness (SMS) occurred in the first few days of space flight correlated with the vestibular function. As the main influence of weightlessness in space focused on the otolith receptors. The test of otolith function is of great importance. Although there are a lot of methods to test otolith function, at present ocular counterrolling is the only relative pure indicator of otolith function. It provides a valid method for predicting SMS susceptibility, it has great application prospect in the research of the SMS mechanism and the readaptability of vestibular function after space flight, it also provides great reference in the clinical diagnosis of vestibular problems.
Author
Aerospace Medicine; Ocular Circulation; Vestibules; Otolith Organs; Function Space

20000025560 Institute of Space Medico-Engineering, Beijing, China
Developments of the Theory of Skeletal Adaptation to Mechanical Loading
Xie, Li–Qin, Institute of Space Medico-Engineering, China; Liu, Cheng–Lin, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Jun. 1999; ISSN 1002-0837; Volume 12, No. 3, pp. 226-230; In Chinese
Report No.(s): CN-11-2774/R; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The primary mechanical function of bone is to provide rigid levers for limbs to act against mechanical loading and gravity, and to remain as light as possible to allow efficient locomotion. There are increasing evidence that mechanical loading is an important, if not the most important, factor influences bone mass and architecture. Many bones are exposed to thousands of repetitive loads every day, which always cause strains. Unusual strain distributions, high strains, and high strain rates seem to be particularly osteogenic. Bone modeling can increase bone strength and mass, bone remodeling can conserve or reduce them, and each can be turned ON or OFF in response to its own threshold range of bone strains. During growth and development, the skeleton optimizes its architecture and strength by (re)modeling to adapt to the largest voluntary loads on bones. The loads come from muscles, not body weight. A new standard of defining osteoporosis might relate bone strength to muscle strength that concerns the osteopenias pathogenesis and its severity, and it would be useful for prevention and cure of osteoporosis.
Author
Adaptation; Loads (Forces); Aerospace Medicine; Bones

20000025561 Academy of Military Science, Inst. of Hygiene and Environment Science, Tianjin, China

The Relationship Between Optimum Carriage Load and Slope at High Altitude of 3700 m

Yin, Zhao–Yun, Academy of Military Science, China; Zan, Jun–Bing, Academy of Military Science, China; Sun, Xing–Bin, Academy of Military Science, China; Ma, Zhi, Academy of Military Science, China; Nan, Wen–Kao, Academy of Military Science, China; Wang, He–Xin, Academy of Military Science, China; Space Medicine and Medical Engineering; Jun. 1999; ISSN 1002-0837; Volume 12, No. 3, pp. 223-225; In Chinese

Report No.(s): CN-11-2774/R; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

To observe the relationship between optimum carriage load and slope at high altitude. Optimum carriage load was investigated in twelve healthy young men at an altitude of 3700 m. The subjects marched on a treadmill for 10 min at walking speed of 4.0 km/h with different slopes (0 deg, 5 deg, 10 deg, 15 deg) and carriage loads (0, 7, 14, 21 and 28% body weight). Ventilation (V(E)), heart rate (HR) and energy expenditure (E) during marching were measured. The optimum carriage load was estimated by finding the break point of the systematic increase in V(E), HR and E. Optimum carriage load at walking slope of 0 deg, 5 deg, 10 deg and 15 deg were 20.5, 13.8, 7.0 and 0.4 kg, respectively. The relationship between the reduction in optimum carriage load and slope has been estimated to be on the order of about 7 kg for every slope of 5 deg at high altitude of 3700 m. Author

Carriages; Loads (Forces); Aerospace Medicine; Slopes

20000025565 Southeast Univ., Dept. of Biomedical Engineering, Nanjing, China

An Experimental Study on 3-D Human Body Virtual Endoscope

Li, Nai–Hong, Southeast Univ., China; Yu, Wen–Xue, Southeast Univ., China; Luo, Li–Min, Southeast Univ., China; Space Medicine and Medical Engineering; Jun. 1999; ISSN 1002-0837; Volume 12, No. 3, pp. 209-213; In Chinese

Report No.(s): CN-11-2774/R; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

To make experimental study on 3-D human body virtual endoscope systematically using 3-D image data of a human body. The geometrical model and locating of a virtual endoscope were built. by the model, we can view a virtual human body in different directions and resolutions. Then, method of ray tracing for surface detection and tri-linear interpolation for surface rendering were applied to visualize the result of virtual endoscope. A virtual endoscope system based on PC that uses the method were given and a few virtual endoscope images of 3-D human body image data were also presented. Virtual endoscope is one of the most hopeful methods for virtual diagnosis, virtual therapy and virtual teaching.

Author

Aerospace Medicine; Endoscopes; Human Body

20000025566 Xian Jiaotong Univ., Biomedical Engineering Inst., China

Detection of Spikes in Epileptic Electroencephalography by using Wavelet Series

Huan, Fei, Xian Jiaotong Univ., China; Zheng, Chong–Xun, Xian Jiaotong Univ., China; Huang, Yuan–Gui, Xian Jiaotong Univ., China; Space Medicine and Medical Engineering; Jun. 1999; ISSN 1002-0837; Volume 12, No. 3, pp. 200-203; In Chinese

Report No.(s): CN-11-2774/R; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

To study automatic detection of the spikes in the epileptic EEG signals. Based on wavelet series decomposition of EEG signals, the mean amplitude between two cross-zeros of the detail signals at every scale was utilized to obtain quantitative values for the transient waves, and the abnormal spikes were distinguished from normal background EEG activities by the local maximum of the mean amplitudes of the different scales. The analysis of 6 patients' EEG data showed that the correctness ratio was 79.66% in detecting the spikes. The epileptiform spikes in the abnormal EEG can be accurately detected with this method. Author

Electroencephalography; Detection; Epilepsy; Spike Potentials; Aerospace Medicine

20000025567 Institute of Space Medico-Engineering, Beijing, China

Counteracting Effect of Chinese Herbs on "Insufficiency of Spleen Qi" Induced by Simulated Weightlessness

Shi, Hong–Zhi, Institute of Space Medico-Engineering, China; Wang, Bao–Zhen, Institute of Space Medico-Engineering, China; Gao, Jian–Yi, Institute of Space Medico-Engineering, China; Qian, Jin–Kang, Institute of Space Medico-Engineering, China; Fan, Quan–Chun, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Jun. 1999; ISSN 1002-0837; Volume 12, No. 3, pp. 197-199; In Chinese

Report No.(s): CN-11-2774/R; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

To observe the counteracting effect of a Chinese herb-compound on "insufficiency of spleen qi" induced by simulated weightlessness, animal and human experiment were carried out to the Chinese herb-compound (Dangshen, Baizhu, Fuling etc). The result is that this compound protected the tail suspended rats from atrophy of spleen, thymus, soleus and gastrocnemius

muscles, prevented excessive decrease of body weight effectively; at the same time it relieved the symptoms of the subjects greatly. It demonstrated that the compound decreased the ”insufficiency of spleen qi” of both animals and human subjects.
Author
Weightlessness Simulation; Aerospace Medicine; Spleen

20000025568 Institute of Space Medico-Engineering, Beijing, China
Bifurcation and Chaos of Heart Cell Pacing Rhythm Evoked by Changing [Ca(++)](sub o) in Body Fluid
Gu, Hua–Guang, Institute of Space Medico-Engineering, China; Ren, Wei, Institute of Space Medico-Engineering, China; Jiang, Shi–Zhong, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Jun. 1999; ISSN 1002-0837; Volume 12, No. 3, pp. 188-192; In Chinese
Report No.(s): CN-11-2774/R; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The objective is to study the effect of changes of electrolyte concentration on heart cell pacing rhythm. The minimal model of gating mechanism for ionic channels of exciting cells was used in this study. ISI (interspike interval) is regarded as the key parameter. ISI appears period, chaos, period adding bifurcation and period doubling bifurcation when V(c), a parameter related to [Ca(++)](sub o), was adjusted. The results reveal that changes of [Ca(++)](sub o) may evoke changes of rhythm of heart pacemaker cells. This implies that changes of [Ca(++)](sub o) of body fluid are a cause influencing pacing rhythm of pacemaker cells and cardiac arrhythmia besides the neuro-humoral regulation, which should not be ignored.
Author
Aerospace Medicine; Chaos; Heart Rate; Body Fluids; Electrolytic Cells; Rhythm (Biology); Bifurcation (Biology)

20000025569 Institute of Space Medico-Engineering, Beijing, China
Counteracting Effect of Chinese Herbs-Compounds on ”Blood Stasis” Induced by Bed Rest
Wang, Bao–Zhen, Institute of Space Medico-Engineering, China; Shi, Hong–Zhi, Institute of Space Medico-Engineering, China; Gao, Jian–Yi, Institute of Space Medico-Engineering, China; Fan, Quan–Cun, Institute of Space Medico-Engineering, China; Xu, Zhi–Ming, Institute of Space Medico-Engineering, China; Qian, Jin–Kang, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Jun. 1999; ISSN 1002-0837; Volume 12, No. 3, pp. 193-196; In Chinese
Report No.(s): CN-11-2774/R; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The objective is to observe the improved effect of syndromes of blood stasis by taking Chinese medicine during bed-rest simulated weightlessness. Ten subjects were randomly divided into two groups: Chinese medicine group and control group. Both of them were exposed to HDBR-6 deg for a week. The Chinese medicine group took Chinese medicine during the bed rest, and the control group took sugar water. Syndromes of blood stasis of Chinese medicine group had a significant relief and some physiological parameters, such as blood pressure, pulse graph, and amount of urine, maintained the level of pre-bed rest. While the control group was more severe than the Chinese medicine group in syndromes of blood stasis. Chinese medicine can be a measure in preventing the effect of weightlessness.
Author
Aerospace Medicine; Blood; Bed Rest

20000025570 Institute of Space Medico-Engineering, Beijing, China
The Preliminary Nonlinear Dynamical Analysis of Surface Electromyogram
Yang, Jian–Qun, Institute of Space Medico-Engineering, China; Liu, Bing–Zheng, Institute of Space Medico-Engineering, China; Peng, Jian–Hua, Institute of Space Medico-Engineering, China; Ma, Zhi–Jia, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Jun. 1999; ISSN 1002-0837; Volume 12, No. 3, pp. 185-187; In Chinese
Report No.(s): CN-11-2774/R; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The objective is to study the nonlinear characteristics of the surface electromyogram(EMG). Method EMG was studied with physical quantities (i.e. complexity, correlation time, correlation dimension, Lyapunov exponent and entropy) which are commonly used in nonlinear dynamics. Pairs of contracted and relaxed muscles were analyzed. The results show that EMG is more stochastic in the contracted state and more regular in the relaxed state. Except for the amplitude of EMG used in conventional method, quantities used in nonlinear dynamics such as complexity, correlation time Lyapunov exponent etc, are also helpful in defining the characteristics of EMG.
Author
Electromyography; Aerospace Medicine

20000025571 Institute of Space Medico-Engineering, Beijing, China

Physiological Analysis of a Mathematical Model for Predicting Somatic Eigenstates Under Combined Stresses

Yu, Xue–Jun, Institute of Space Medico-Engineering, China; Jia, Si–Guang, Institute of Space Medico-Engineering, China; Chen, Jing–Shan, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Jun. 1999; ISSN 1002-0837; Volume 12, No. 3, pp. 181-184; In Chinese

Report No.(s): CN-11-2774/R; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The objective is to put a mathematical model for predicting human Somatic eigenstates (HS) into practical engineering design of countermeasures against combined stresses (hypoxia, heat, noise and vibration) in an aircraft cabin, and confirm the model from the human physiological viewpoint. Published works on these 4 stresses were employed to verify the main and interactive effects which had been previously proved mathematically. The main effects of 4 stresses and the significant interactive effects of 2 from 4 stresses agreed with the published experiments in single or in the same combination of these stresses. The model is reasonable in human physiological consideration and has been adopted in engineering design.

Author

Aerospace Medicine; Mathematical Models; Eigenvectors; Combined Stress; Physiology

20000025573 Fourth Military Medical Univ., Dept. of Aerospace Biodynamics, Xi'an, China

Characteristics of Dynamic Loading and the Cushioning Effect of Tempormadibular Joints during Impact on Chins in Goat and Man

Hao, Wei–Ya, Fourth Military Medical Univ., China; Wang, Mei–Qing, Fourth Military Medical Univ., China; He, Yang–Ju, Fourth Military Medical Univ., China; Yuan, Fang, Fourth Military Medical Univ., China; Space Medicine and Medical Engineering; Jun. 1999; ISSN 1002-0837; Volume 12, No. 3, pp. 173-176; In Chinese

Report No.(s): CN-11-2774/R; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The objective is to investigate the dynamic load characteristics of mandible-tempormadibular joints (TMJ) -skull during blunt impact on the chin. Twelve goat heads were randomly divided into two groups, and were employed in a cross-control trial. Group 1 was first impacted by a blunt mass with a velocity (v(1) = 1.1 ms) for three times, and then with another velocity (V(2) = 1.6 m/s) for three times; group 2 was impacted with V(2) and then v(1) for similar times too. Two fresh human heads were experimented in the same way as goat heads in group 1. The same impact mass was used in all the experiments. The impact was exerted along the chin and vertically to the junctional line of both sides of TMJs. The results are: (1)The cross-control trial of goat heads showed that repeated impact didn't make any difference (P is greater than 0.05) in the results of our experiment. (2) The impact time (t) in v(1) of human heads (44.14 +/- 3.33 ms) was longer than that of V(2) (39.23 +/- 1.60 ms) but without any statistical difference (P is greater than 0.05), while the peak values of impact forces (F(p)) and slide forces of v(1) (169.20 +/- 23.58 N, 105.37 +/- 20.96 N) were both significantly lower than those in v(2) (319.42 +/- 35.7 N, 155.67 +/- 25.67 N) P is less than 0.0 1). (3) With the same impact velocities, the human groups had longer t (P is less than 0.01), but lower F(p)(P is less than 0.01) as compared with the goat heads; furthermore, their force-time curves were different. We conclude that (1) The dynamic load curves of human heads during impact on chins were obtained. (2) The anatomy structure of human TMjs enable it to well cushion the impact forces. (3) The impact forces rise significantly with the increase of impact velocity with which the impact time decrease.

Author

Chin; Aerospace Medicine; Dynamic Loads; Cushions; Skull

20000025575 Institute of Space Medico-Engineering, Beijing, China

Effect of Extremely Low Frequency Magnetic Field on Brain Response to Selective Mental Arithmetic Under Simulated Weightlessness

Zhao, Lun, Institute of Space Medico-Engineering, China; Wei, Jin–He, Institute of Space Medico-Engineering, China; Yan, Gong–Dong, Institute of Space Medico-Engineering, China; Chen, Wen–Juan, Institute of Space Medico-Engineering, China; Duan, Ran, Institute of Space Medico-Engineering, China; Ren, Wei, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Jun. 1999; ISSN 1002-0837; Volume 12, No. 3, pp. 161-164; In Chinese

Report No.(s): CN-11-2774/R; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The objective is to study effects of extremely low frequency magnetic field (ELMF) on brain function state during weightlessness. The brain event-related potentials (ERPs) during a selective mental arithmetic task were compared in 40 normal subjects (20-25 yrs) before and after ELMF (5 Hz) stimulation during simulated weightlessness(head down tilt - 10 deg, HDT). The amplitude of slow positive potentials which were supposed to be related to the mental arithmetic activity decreased

significantly especially in 100 min after HDT, but it did not decrease significantly after ELMF stimulation. ELMF stimulation may improve the brain function state during simulated weightlessness.
Author
Aerospace Medicine; Magnetic Fields; Brain; Physiological Responses; Mental Performance; Magnetic Effects

20000025576 Institute of Space Medico-Engineering, Beijing, China
Study on Testing Method of Susceptibility to Decompression Sickness in Aerospace
Zhang, Jing–Xue, Institute of Space Medico-Engineering, China; Peng, Yuan–Kai, Institute of Space Medico-Engineering, China; Zhang, Bao–Lan, Institute of Space Medico-Engineering, China; Wang, Cheng–Min, Institute of Space Medico-Engineering, China; Fu, Hong–Wei, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Jun. 1999; ISSN 1002-0837; Volume 12, No. 3, pp. 157-160; In Chinese
Report No.(s): CN-11-2774/R; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The objective is to provide related parameters for astronauts. A study of susceptibility to decompression sickness was carried out in 43 subjects in a hypobaric chamber. Incidence of altitude decompression sickness under rest condition was closely related to age, time of oxygen prebreathing, gas bubble formation rates in the venous blood flow returned to heart and some other physiological indexes. Incidence of decompression sickness was significantly higher in subjects aged 30 - 36 years than in those aged 19 - 20 years under the same experimental conditions. In the older subjects body-fat, blood cholesterol and noradrenaline in urine during experiment were significantly higher than those in the younger subjects. It also showed that among persons of the same ages, when prebreathing time was longer, the incidence of decompression sickness was significantly lower under the same experimental conditions. It is desirable that the susceptibility to decompression in astronaut be tested with 1 h oxygen prebreathing before exposure to the altitude of 10000 m for 30 min.
Author
Aerospace Medicine; Decompression Sickness; Magnetic Permeability; Altitude Sickness

20000025956 Norwegian Defence Research Establishment, Kjeller, Norway
Immuno- and Neurotoxic Effects of Ortho-Substituted Polychlorinated Biphenyls (PCBs)
Voie, Oyvind Albert, Norwegian Defence Research Establishment, Norway; Nov. 08, 1999; 136p; In English
Contract(s)/Grant(s): FFIBM Proj. 293001
Report No.(s): FFI/PUBLICATION-99/05502; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The present study shows that polychlorinated and polybrominated biphenyls elevate intracellular free [Ca2+] and activate respiratory burst in human granulocytes. The mechanism of intracellular [Ca2+] elevation appears to occur by activation of phospholipase C, which leads to the production of inositol 1,4,5-triphosphate. This will release Ca2+ from intracellular stores and subsequently activation of Ca2+ release activated Ca2+ channel (CRAC) in the plasma membrane. The mechanism activating respiratory burst by PCBs appears to involve activation of phospholipase D or phospholipase C, tyrosine kinase and protein kinase C prior to the activation of NADPH oxidase. This could in part account for the effects of PCB on the immune system. The structure-activity relationship studies reveal that dichloro biphenyls up to hexachloro biphenyls are active. At least 1 chlorine in ortho position is needed to activate respiratory burst. Ortho-substituted PCB congeners with large total surface area are not active. Congeners with a very specific 2,4,6-substitution on one biphenyl ring are optimal activators. All three factors, size, rotation, and electronic properties, which are not independent of each other,are important for the activity of the PCBs. Polychlorinated biphenyls also increase the production of reactive oxygen species (ROS) in rat brain synaptosomes by a mechanism that appear to involve phospholipase C or D and tyrosine kinase. This effect may contribute to the many neurobehavioral and neurotoxicological effects observed after PCB exposure. Ortho-substituted PCB congeners are active, but also a dimeta-substituted congener is found to be active. A tetra ortho-substituted congener is not active. This indicates that multiple structural requirements are involved in PCB activity in vitro.
Author
Polychlorinated Biphenyls; Immunology; Neurology; Substitutes; Cells (Biology); Toxicology

20000026304 Cleveland Clinic Foundation, Cleveland, OH USA
Lower Limb Response to Impact Loads in 1G and Micro-G
Davis, Brian, Cleveland Clinic Foundation, USA; Kambic, Helen E., Cleveland Clinic Foundation, USA; Grabiner, Mark D., Cleveland Clinic Foundation, USA; Sferra, James, Cleveland Clinic Foundation, USA; KC-135 and Other Microgravity Simulations; August 1999, pp. 3-6; In English; See also 20000026303; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The overall goals of this study are 1) to demonstrate that jumping exercises may be more effective and efficient than current exercises performed in zero-gravity with respect maintaining bone density and muscle strength; 2) to validate the zero-gravity simulator as an appropriate substitute for true zero-gravity experiments during development of an optimum exercise regime; and 3) to quantify relationships between external loading profiles and internal bone strains.
Author
Impact Loads; Physical Exercise; Weightlessness; Bone Demineralization; Osteoporosis; Musculoskeletal System; Biological Effects; Physiological Effects; Microgravity; Atrophy; Bioastronautics

20000026306 NASA Ames Research Center, Moffett Field, CA USA
Physiologic Pressure and Flow Changes During Parabolic Flight (Pilot Study)
Pantalos, George, Utah Univ., USA; Sharp, M. Keith, Utah Univ., USA; Mathias, John R., Texas Univ., USA; Hargens, Alan R., NASA Ames Research Center, USA; Watenpaugh, Donald E., University of North Texas, USA; Buckey, Jay C., NASA Johnson Space Center, USA; KC-135 and Other Microgravity Simulations; August 1999, pp. 11-13; In English; See also 20000026303; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The objective of this study was to obtain measurement of cutaneous tissue perfusion central and peripheral venous pressure, and esophageal and abdominal pressure in human test subjects during parabolic flight. Hemodynamic data recorded during SLS-I and SLS-2 missions have resulted in the paradoxical finding of increased cardiac stroke volume in the presence of a decreased central venous pressure (CVP) following entry in weightlessness. The investigators have proposed that in the absence of gravity, acceleration-induced peripheral vascular compression is relieved, increasing peripheral vascular capacity and flow while reducing central and peripheral venous pressure, This pilot study seeks to measure blood pressure and flow in human test subjects during parabolic flight for different postures.
Author
Blood Pressure; Heart; Hemodynamic Responses; Posture; Stroke Volume; Weightlessness; Parabolic Flight; Weightlessness Simulation; Heart Function; Aerospace Medicine; Bioastronautics

20000026307 Utah Univ., Salt Lake City, UT USA
Modeling of Cardiovascular Responses to Weightlessness
Sharp, M. Keith, Utah Univ., USA; Pantalos, George, Utah Univ., USA; Gillars, Kevin D., Utah Univ., USA; KC-135 and Other Microgravity Simulations; August 1999, pp. 14-16; In English; See also 20000026303; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Hemodynamic data recorded during SLS-1 and SLS-2 missions have resulted in the paradoxical finding of increased cardiac stroke volume in the presence of a decreased central venous pressure following entry in weightlessness. Chronic observations from space flight also describe a headward shift of the circulating fluid volume. The investigators have proposed that in the absence of gravity, acceleration-induced effects such as hydrostatic pressure and peripheral vascular compression are relieved, increasing central and peripheral vascular capacity and flow while reducing central and peripheral venous pressure and augmenting cardiac diastole function. This investigation seeks to measure key hemodynamic parameters to assess the purely biomechanical component of these observations in the acute-phase response during parabolic flight for different models postures.
Derived from text
Blood Pressure; Cardiovascular System; Circulation; Heart Function; Hemodynamic Responses; Weightlessness; Microgravity; Gravitational Physiology; Bioastronautics

20000026308 NASA Johnson Space Center, Houston, TX USA
ISS Medical Checklist Procedures Validation and Training
Marshburn, Tom, NASA Johnson Space Center, USA; Goode, Julie, Wyle Labs., Inc., USA; KC-135 and Other Microgravity Simulations; August 1999, pp. 17-20; In English; See also 20000026303; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The Health Maintenance System (HMS) hardware will be used to support a medical contingency for the International Space Station (ISS). During two test flights, the procedures for performing Advanced Cardiac Life Support (ACLS) were evaluated to determine the required level of detail, assess the logic of the steps and division of tasks among crew members.
Derived from text
Flight Tests; Onboard Equipment; Medical Equipment; Emergency Life Sustaining Systems; First Aid; Resuscitation; Emergency Breathing Techniques; Weightlessness; Aerospace Medicine

20000026309 Wyle Labs., Inc., Life Sciences, Houston, TX USA

Blood Sampling Kit Evaluation

Gunter, Karen, Wyle Labs., Inc., USA; KC-135 and Other Microgravity Simulations; August 1999, pp. 21-24; In English; See also 20000026303; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The goal of this study is to evaluate the components of a blood sampling kit, designed for use during space flight. The kit contains all the components that astronauts require to obtain necessary blood samples in microgravity.

Author

Blood; Kits; Microgravity; Sampling; Medical Equipment; Aerospace Medicine

20000026312 Washington Univ., Seattle, WA USA

Contribution of Gravity to Lung Blood Flow Heterogeneity

Hlastala, M., Washington Univ., USA; Robertson, H. Thomas, Washington Univ., USA; An, Doan, Washington Univ., USA; Bernard, Susan, Washington Univ., USA; Chornuk, Myron, Washington Univ., USA; Glenny, Robb W., Washington Univ., USA; Lamm, Wayne J. E., Washington Univ., USA; Wagner, Wiltz W., Indiana School of Medicine, USA; KC-135 and Other Microgravity Simulations; August 1999, pp. 44-47; In English; See also 20000026303; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The estimation of blood flow distribution in the lung obtained from indirect gas concentration methods on the SLS-1 yielded a very surprising result, in that the distribution of blood flow in the lung did not appear to be substantially altered by weightlessness. The best explanatory model for the distribution of blood flow to the lung prior to those findings had been the three zone model, which postulated that the regional flow differences could be satisfactorily explained by the influence of gravity on the low pressure blood flow circuits of the lung. The measurements obtained by West and colleagues had relatively low spatial resolution. Subsequent investigators using lungs injected with microspheres as flow markers, inflated, and cut into thousands of pieces demonstrated a far greater degree of heterogeneity than would have been predicted from the simple gravitational model, While the gravitational gradient could still be detected by these studies, it was calculated to account for only about 7% of the total flow heterogeneity. The calculations on experiments conducted at 1 G were only indirect evidence of a weaker effect of gravity, however, as the effects of gravity were estimated from the changes measured in blood flow in animals turned from prone to supine position. What was lacking was direct measurement of blood flow distribution at microgravity and at higher G forces in the same animals. The NASA KC-135 aircraft provided the opportunity to directly investigate the effects of microgravity on blood flow distribution on the lungs of anesthetized animals utilizing the high resolution techniques we had developed in our laboratories.

Author

Blood Flow; Gravitational Effects; Lungs; Microgravity; Weightlessness; Gravitational Physiology; Aerospace Medicine; Pulmonary Circulation

20000026314 California Univ., San Diego, CA USA

Pulmonary Deposition of Aerosols in Microgravity

Prisk, G. Kim, California Univ., USA; Darquenne, Chantal J., California Univ., USA; West, John B., California Univ., USA; KC-135 and Other Microgravity Simulations; August 1999, pp. 51-58; In English; See also 20000026303; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

The goal of this study is to perform testing aboard the KC-135 resulting in applications that promote a better understanding of pulmonary diseases related to inhaled particles, in studying drugs delivered by inhalation, and in understanding the consequence of long-term exposure to respirable aerosols in long duration space flight. This study was designed to determine the total deposition of aerosols in the human lung in microgravity, in normal gravity (1G) and in hypergravity (about 1.6 G), and to chart the deposition and dispersion of aerosols (inhaled boli of 1 micron particles) as a function of the penetration depth into the lung at microgravity, 1G and about 1.6G.

Derived from text

High Gravity Environments; Long Duration Space Flight; Lungs; Microgravity; Respiratory Diseases; Aerosols

20000026326 NASA Johnson Space Center, Houston, TX USA

Development of a Whole Blood Staining Device for use During Space Shuttle Flights

Sams, Clarence F., NASA Johnson Space Center, USA; Crucian, Brian E., Wyle Labs., Inc., USA; Clift, Vaughan L., Lockheed Nartin, Inc., USA; Meinelt, Ellen M., Wyle Labs., Inc., USA; KC-135 and Other Microgravity Simulations; August 1999, pp. 114-116; In English; See also 20000026303; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Exposure to microgravity during space flight results in profound physiologic changes. Numerous studies have shown changes in circulating populations of peripheral blood immune cells immediately after space flight. It is currently unknown if these changes result from exposure to microgravity or are caused by the stress of reentry and readaptation to gravity. We have developed the whole blood staining device as a system for the staining of whole blood collected during space flight for subsequent flow cytometric analysis, This device contains all liquids to address safety issues concerned with space flight and also moves the cells through the staining, lyse/fixation and dilution steps.
Derived from text
Blood; Microgravity; Aerospace Medicine; Weightlessness; Medical Equipment

20000026328 Chisum High School, Paris, TX USA
"Fly High" Program: The Effects of Microgravity on the Human Body
Wood, Kris, Chisum High School, USA; Bradberry, Davin, Chisum High School, USA; Cassell, Cari, Pittsburg High School, USA; Cheshier, Matt, Pittsburg High School, USA; Denney, John, Pittsburg High School, USA; Hubbard, Jason, Pittsburg High School, USA; Edwards, Crystal, Satillo High School, USA; James, Ashley, Satillo High School, USA; Brewer, Kelli, Satillo High School, USA; Floyd, Crystal, Satillo High School, USA; KC-135 and Other Microgravity Simulations; August 1999, pp. 121-123; In English; See also 20000026303; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The goal of this project was to measure blood pressure, pulse, and reflexes in a microgravity environment and then compare them to a preflight base line.
CASI
Blood Pressure; Microgravity; Reflexes; Heart Function; Heart Rate; Weightlessness; Bioastronautics

20000026329 New Caney High School, New Caney, TX USA
"Fly High" Program: Development of Motion Sickness and Postural Ataxia in a Reduced Gravity Environment
Parker, Christie, New Caney High School, USA; Pena, Fernando, New Caney High School, USA; Shepard, Vincent, New Caney High School, USA; Yager, Kristy, New Caney High School, USA; Guidry, Amy, New Caney High School, USA; Hobbs, Courtney, New Caney High School, USA; Kahl, Anthony, New Caney High School, USA; Moore, Clint, New Caney High School, USA; Nielson, Jennifer, New Caney High School, USA; Pena, Phillip, New Caney High School, USA; KC-135 and Other Microgravity Simulations; August 1999, pp. 124-127; In English; See also 20000026303; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Motion sickness and postural ataxia often present a problem for astronauts and cosmonauts on missions, causing delays in schedule, and occasionally causing a mission to be actually inefficient. As evidence provided indicates, 40-70 % of astronauts will experience in-flight neurovestibular effects. These include postural illusions, tumbling sensations, nystagmus, vertigo, and space motion sickness: pallor, cold sweating, nausea or vomiting. These symptoms usually appear early in the course of the flight, and disappear or subside within a few days. Because the effects of motion sickness can inhibit the progress of astronauts in regard to their experiments, the original reason for launching these costly missions can be delayed or essentially lost. Thus, it becomes evident that further research into preventing or alleviating the effects of motion sickness is necessary, and would be highly beneficial to the productivity of space missions. Since the field of subjects that have actually flown on such space missions is limited, and because the onset of motion sickness/postural ataxia is almost immediate upon reaching zero-gravity, experiments using the parabolic flight of the KC-135 can be used to generate data related to this condition.
Derived from text
Ataxia; Microgravity; Motion Sickness; Posture; Vomiting; Weightlessness; Aerospace Medicine; Nausea

20000026335 NASA Johnson Space Center, Houston, TX USA
Medical Operation KC-135 Familiarization Flight
Dawson, Chris, Wyle Labs., Inc., USA; Stoner, Paul, NASA Johnson Space Center, USA; Arenare, Brian, Texas Univ. Medical Branch, USA; Strickland, Angie, Wyle Labs., Inc., USA; Rudge, Fredrick, Patrick Air Force Base, USA; Lowdermilk, Greg, Patrick Air Force Base, USA; KC-135 and Other Microgravity Simulations; August 1999, pp. 151-156; In English; See also 20000026303; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

As new personnel join the Medical Operations Branch, it is critical that they understand the effects of microgravity on medical procedures, hardware, and supplies. The familiarization flight provided new personnel with a better understanding of the effects of microgravity on (1) medical procedures, (2) patient and rescuer restraint, (3) medical fluids, and (4) medical training for space

flight. The flight process also provided experience in flight proposal preparation, flight test plan preparation and execution, and final report preparation. In addition, first time flyers gained insight on their performance level in microgravity for future flights. Derived from text

Microgravity; Medical Services; Aerospace Medicine

20000026858 Miami Univ., School of Medicine, FL USA

Sensory and Motor Responses to Spinal Cord Injury ***Final Report***

Yezierski, Robert P., Miami Univ., USA; Jan. 01, 1999; 12p; In English

Contract(s)/Grant(s): DAAH04-94-G-0425

Report No.(s): AD-A369855; ARO-32837.ll-LS; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The goal of Dr. Yezierski's research was to gain a better understanding of the anatomical, neurochemical and functional changes that occur within the central nervous system following spinal cord injury (SCI). During the funding period, efforts focused on changes within the injured spinal cord as well as on neurons at supraspinal sites. to survey the functional status of neurons at sites in cortical and subcortical structures three studies were initiated. These included efforts to evaluate changes in: (a) blood flow; (b) metabolic state; and (c) genetic expression in diencephalic structures following SCI. An investigation was completed of the physiological changes in spinal sensory neurons following injury. A study was also completed in which a comparison was made between the excitotoxic properties of NMDA and AMPA in an effort to further characterize the pathological consequence of different EAA receptor agonists in SCI.

Author

Blood Flow; Metabolism; Spinal Cord; Spine; Sensory Perception; Physiology; Physiological Responses

20000027540 Civil Aeromedical Inst., Oklahoma City, OK USA

Blood Carbon Monoxide and Hydrogen Cyanide Concentrations in the Fatalities of Fire and Non-Fire Associated Civil Aviation Accidents, 1991-1998 ***Final Report***

Chaturvedi, Arvind K., Civil Aeromedical Inst., USA; Smith, Dudley R., Civil Aeromedical Inst., USA; Canfield, Dennis V., Civil Aeromedical Inst., USA; February 2000; 14p; In English

Report No.(s): DOT/FAA/AM-00/9; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Postmortem blood samples submitted to the Federal Aviation Administration's Civil Aeromedical Institute (CAMI) from fatal civil aviation accident victims are analyzed for the primary toxic combustion gases carbon monoxide (CO), as carboxyhemoglobin (COHb), and hydrogen cyanide, as cyanide (CN). These analyses are performed to establish possible exposure of victims to smoke produced during in-flight/post-crash fires or to CO leaked into cabin/cockpit from faulty exhaust/heating systems. The presence of both gases in blood would suggest that the victim was alive and inhaled smoke from a fire. If only COHb is elevated, then the accident (or death) could be the result of CO contamination of the interior. Information pertaining to blood levels of the 2 gases in aviation fatalities, in relation to the associated accidents, is scattered or not available, particularly with regard to toxicity. Therefore, considering that COHb is greater than or = 10% and CN is greater than or = 0.25 micro-g/mL are sufficient to produce some degree of undesired physiological effects, the necessary information was extracted from the CAMI's toxicology database. Biological samples from 3857 fatalities of 2837 civil aviation accidents, occurring during 1991 - 1998, were received at CAMI. Out of these, 1012 accidents, encompassing 1571 (41%) fatalities, were fire associated, whereas 1820 accidents were non-fire related. The remaining 5 accidents were of unkown fire status. There were fewer fire-related fatalities and associated accidents in the category wherein COHb is greater than or = 10% and CN is greater than or = 0.25 micro-g/mL than that in the category wherein COHb is less than 10% and CN is less than 0.25 micro-g/mL. No in-flight fire was documented in the former category, but in- flight fires were reported in 14 accidents (18 fatalities) in the latter category. No fatality under non-fire accidents was found in which the levels of both gases were determined to be at or above the stated levels. There were 15 non-fire accidents with 17 fatalities in which only COHb (10-69%) was elevated, indicating that these accidents were associated with the inhalation of CO of non-fire origin. The present study suggests that the aviation fire accidents/fatalities were fewer than the aviation non-fire accidents/fatalities, with the fact that the fire-associated fatalities had COHB and CN' at levels high enough to produce some degree of impairment/toxicity. Furthermore, the study confirms that aviation accidents related to in-flight fires and to CO-contaminated interiors are rare.

Author

Toxicology; Carbon Monoxide; Carboxyhemoglobin; Cyanides; Aircraft Accidents; Aerospace Medicine; Toxicity; Blood; Fires

20000027632 National Eye Inst., Bethesda, MD USA

Clinical Trials in Vision Research: Information for Patients

Nov. 1999; 32p; In English

Report No.(s): PB2000-102961; NIH/PUB-99-4124; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Partial Contents: What kinds of clinical trials are there; How is a clinical trial conducted; What are the benefits of participating in a clinical trial; How is patient safety protected; What questions should you ask before deciding to join a clinical trial; What is the National Eye Institute.

NTIS

Patients; Aerospace Medicine; Visual Perception

20000027646 National Inst. of Health, Office of the Director, Bethesda, MD USA

NIH Almanac: 1999 ***Annual Report***

Sep. 1999; 170p; In English

Report No.(s): PB2000-102832; NIH/PUB-99/5; No Copyright; Avail: CASI; A02, Microfiche; A08, Hardcopy

Begun as a one-room Laboratory of Hygiene in 1887, the National Institutes of Health today is one of the world's foremost biomedical research centers. An agency of the Department of Health and Human Services, the NIH is the Federal focal point for health research. NIH is the steward of biomedical and behavioral research for the Nation. Its mission is science in pursuit of fundamental knowledge about the nature and behavior of living systems and the application of that knowledge to extend healthy life and reduce the burdens of illness and disability. The goals of the agency are as follows: (1) foster fundamental creative discoveries, innovative research strategies, and their applications as a basis to advance significantly the Nation's capacity to protect and improve health; (2) develop, maintain, and renew scientific human and physical resources that will assure the Nation's capability to prevent diseases; (3) expand the knowledge base in biomedical and associated sciences in order to enhance the Nation's economic well-being and ensure a continued high return on the public investment in research; (4) exemplify and promote the highest level of scientific integrity, public accountability, and social responsibility in the conduct of science.

NTIS

Human Resources; Medical Services; Health; Research Management

53
BEHAVIORAL SCIENCES

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

20000025530 Civil Aeromedical Inst., Oklahoma City, OK USA

The Effects of Napping on Night Shift Performance ***Final Report***

DellaRocco, Pamela S., Civil Aeromedical Inst., USA; Comperatore, Carlos, Civil Aeromedical Inst., USA; Caldwell, Lynn, Civil Aeromedical Inst., USA; Cruz, Crystal, Civil Aeromedical Inst., USA; February 2000; 38p; In English

Report No.(s): DOT/FAA/AM-00/10; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This study represents a collaborative effort between the Federal Aviation Administration's Civil Aeromedical Institute and the US Army Aeromedical Research Laboratory to investigate the effects of napping on the midnight shift as a potential countermeasure to sleepiness during the shift. The purpose of the present paper was to examine the patterns of performance degradation along with the subjective measures of mood, sleep quality, and sleepiness as a function of napping condition and time on task during the midnight shift. Sixty Air Traffic Control Specialists (ATCSS) were randomly assigned to one of the three midnight shift napping conditions: a long nap (LN) of 2 hours, a short nap (SN) of 45 minutes, and a no nap condition (NN). ATCSs completed a four-day protocol during which they worked three early morning shifts (0700-1500) followed by a rapid rotation to the midnight shift (2300-0700). Subjects completed three 1.5 hour test sessions (one session before the nap and 2 sessions after the nap) during the midnight shift involving two computer-based tasks: (1) the Air Traffic Scenarios Test (ATST), a task developed for selection of ATCSS; and (2) the Bakan, a test of vigilance. Data were analyzed using repeated measures analysis of variance and post-hoc multiple comparisons. Both cognitive performance and subjective measures of sleepiness supported the use of naps during the midnight shift. In fact, both the long nap of 2 hours and the short nap of 45 minutes resulted in better performance than no nap on the Bakan test at the end of the midnight shift. A dose-response relationship existed such that the long nap also resulted in better performance than the short nap. The ATST, on the other hand, was much less sensitive to differences in napping condition and even to the natural circadian trough, which would have been expected to affect all groups. Sleepiness ratings on the Stanford Sleepiness Scale suggested that, while sleepiness increased across the midnight shift for all groups, ratings were generally lower for the LN condition and were lower for males in the SN condition, when compared with the NN condition. The present study

suggests that naps taken during the midnight shift could be useful as a countermeasure to performance decrement and sleepiness on the midnight shift.
Author
Air Traffic Controllers (Personnel); Operator Performance; Sleep; Mental Performance; Fatigue (Biology); Stress (Psychology); Night

20000026311 Naval Aerospace Medical Research Lab., Pensacola, FL USA
Vestibular Interactions During and After Head Movements in Hypergravity: Constant 2G Acceleration with Negligible Angular Velocity
Rupert, Angus H., Naval Aerospace Medical Research Lab., USA; Raj, Anil K., Naval Aerospace Medical Research Lab., USA; Muth, Eric R., Naval Aerospace Medical Research Lab., USA; KC-135 and Other Microgravity Simulations; August 1999, pp. 31-43; In English; See also 20000026303; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

The G-excess illusion has been implicated in a significant number of aviation mishaps involving loss of situation awareness. The G-excess illusion can occur when head movements are made in an elevated gravity field, such as in a banked turn or in an accelerating space vehicle. This can cause illusory attitude changes of as much as 90 degrees, depending on type and rate of head movement. In addition, head movements in an elevated gravity field can lead to the development of motion sickness symptoms. The level of motion sickness encountered during a preliminary hypergravity study performed on the KC-135 in 1991 could not be accounted for by coriolis cross coupling effects (the nauseating sense of tumbling produced by head movements in a rotating environment). We employed the KC-135 (as in the 1991 study) as a large centrifuge, flying in a banked turn to generate hypergravity (1.8G). We proposed to investigate the human physiological response to head movements during increased linear acceleration by measuring the vestibulo-ocular reflex (VOR). We recorded perceptual reports of visual illusions of motion as a result of these head movements. We also monitored the onset and progression of motion sickness symptoms during hypergravity with subjective symptom reporting and an objective measure of gastric activity (electrogastrogram). These experiments should lead to better understanding of the mechanism of the g-excess illusion and help develop effective countermeasures for pilots and astronauts returning to the relatively high gravity of the earth after adaptation to microgravity,
Author
High Gravity Environments; Human Reactions; Motion Sickness; Aerospace Medicine; Head Movement; Acceleration Stresses (Physiology)

20000026315 Dartmouth Coll., Hanover, NH USA
Head Direction Cell Activity under Microgravity Conditions
Taube, Jeffrey S., Dartmouth Coll., USA; Oman, Charles S., Dartmouth Coll., USA; Stackman, Robert W., Dartmouth Coll., USA; KC-135 and Other Microgravity Simulations; August 1999, pp. 59-61; In English; See also 20000026303; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The goal of this study is to understand the neurobiology underlying visual reorientation illusions and the etiology of motion sickness. The long-term objectives of the proposed research are to improve our understanding of how spatial orientation information is processed in the vertebrate brain. Specifically, what are the underlying physiological and cognitive mechanisms which normally support an animal's sense of direction and enable it to orient and navigate within a three-dimensional environment? Previous studies in rat hippocampus, subicular complex, and thalamus have identified two classes of exocentric spatial cells in the brain. One type discharges whenever the animal is in a specific location ("place" cells), while the second ("head direction" cells) discharge as a function of the animal's head direction in the earth's horizontal plane, independent of the animal's behavior and location. Based on well established ground-based experimental paradigms, we propose a series of rodent electrophysiological experiments to characterize the behavior of head direction cells in freely moving animals in various non-gravity orientations. Because astronauts frequently experience spatial disorientation during space flights, it is important to understand the underlying neurophysiological mechanisms contributing to spatial orientation in order to eventually develop appropriate countermeasures. The experiments will be performed aboard the KC-135 aircraft; this aircraft flies parabolic flights in order to simulate the effects of micro-gravity.
Derived from text
Brain; Electrophysiology; Motion Sickness; Neurophysiology; Position (Location); Illusions; Microgravity

20000026322 Massachusetts Inst. of Tech., Cambridge, MA USA
Undergraduate Program Flights: PREVIEW (PeRiphEral VIsion Experimentation in Weightlessness)
Hallam, Cory R. A., Massachusetts Inst. of Tech., USA; Chen, Stephanie, Massachusetts Inst. of Tech., USA; Gesch, Julie,

Massachusetts Inst. of Tech., USA; Newman, Dava, Massachusetts Inst. of Tech., USA; Rivkin, Tyra, Massachusetts Inst. of Tech., USA; Sienko, Kathy, Massachusetts Inst. of Tech., USA; Sun, Mark, Massachusetts Inst. of Tech., USA; KC-135 and Other Microgravity Simulations; August 1999, pp. 94-98; In English; See also 20000026303; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

It is well-known that humans subjected to hyper-gravity environments experience the phenomenon of peripheral light loss (PLL) or tunnel vision as it is more commonly known, which is characterized by a narrowing of the visual field. Research on this subject has developed largely in connection with the advent of the high-performance combat aircraft where pilots are routinely subjected to loads of up to 9G for brief periods of time. This information has led to new design considerations for cockpit layouts, in particular the position of mission critical equipment; however, little research has been done to explore the effects of micro-gravity on the peripheral vision field of view (FOV) limits in humans. With the increase in human space-based activity planned for the International Space Station (ISS), the question of knowing if there is a corollary FOV design concern for spacecraft and space station working environments becomes important. This experiment was established to explore the peripheral vision FOV limits in humans in the micro-gravity environment.

Derived from text

Field of View; Microgravity; Peripheral Vision; Visual Fields; Weightlessness

20000026325 Maryland Univ., College Park, MD USA

Undergraduate Program Flights: Correlation of Microgravity Simulation through Fitt's Law

Bendor, Dan, Maryland Univ., USA; Fiterman, Eric, Maryland Univ., USA; Smith, Cristin, Maryland Univ., USA; Johnson, Larry, Maryland Univ., USA; KC-135 and Other Microgravity Simulations; August 1999, pp. 111-113; In English; See also 20000026303; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Our project consists of a correlation study of upper arm mobility in microgravity, neutral buoyancy, and normal 1-g conditions. In order to contrast the different environments, a design to collect data based on Fitt's Law will be used as a measure of coordination.

Author

Microgravity; Weightlessness Simulation; Human Factors Engineering; Human Reactions

20000026331 Brandeis Univ., Waltham, MA USA

Adaptation of Reaching Movements in Artificial Gravity

Lackner, James R., Brandeis Univ., USA; DiZio, Paul, Brandeis Univ., USA; KC-135 and Other Microgravity Simulations; August 1999, pp. 134-137; In English; See also 20000026303; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The goal of this experiment was to understand the role of cutaneous contact cues in control of reaching movements and posture. The objective was to evaluate the force applied by the fingertip when it lands on a horizontal work surface at the end of a reaching movement aimed at a target on the surface.

Derived from text

Artificial Gravity; Posture; Human Performance; Sensorimotor Performance; Reaction Time; Human Reactions

20000026332 Brandeis Univ., Waltham, MA USA

Effects of Background Force Level and Body Orientation on Arm Movement Control

Lackner, James R., Brandeis Univ., USA; DiZio, Paul, Brandeis Univ., USA; KC-135 and Other Microgravity Simulations; August 1999, pp. 138-141; In English; See also 20000026303; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Previous parabolic flight experiments showed that within one second after a transition to 0 g or 1.8 g background force subjects can reproduce a pattern of rhythmic forearm flexion-extension movements that they had learned in a I g environment. Our last set of parabolic flight experiments (6/98) showed that vestibular information about the force background is not necessary for this type of compensation, because a subject lacking vestibular function was as invariant in performance across g levels as normal subjects. Thus, we hypothesized that somatic mechanoreceptors provide cues about the gravitational loads that are automatically compensated. We tested this by observing a deafferented subject and fully sensate control subjects attempting to produce a constant pattern of arm movement while passively placed in different body orientations, in 0 g, 1 g and 1.8 g.

Author

Human Performance; Psychomotor Performance; Human Reactions; Microgravity; High Gravity Environments

20000026859 Utah Univ., Psychology Dept., Salt Lake City, UT USA

1998 Winter Conference on Neurobiology of Learning and Memory

Kesner, Raymond P., Utah Univ., USA; Sep. 29, 1999; 5p; In English; 22nd; Annual Neurobiology of Learning and Memory Conference, 10-13 Jan. 1998, Park City, UT, USA

Contract(s)/Grant(s): N00014-98-I-0141

Report No.(s): AD-A369842; Rept-5-28244; No Copyright; Avail: CASI; A01, Microfiche; A01, Hardcopy

The twenty-second annual Neurobiology of Learning and Memory conference was held in Park City, January 10-13,1998. The conference was organized b Sheri Mizumori, Bryan Kolb, Raymond Kesner, Jim McGaugh, Aryeh Routtenberg and Lary Squire. The conference was well attended with 80 scientists from all parts of the USA as well as 20 graduate and/or postdoctoral students. The topics that were covered included 1) a ”data blitz” which was lead by Sheri Mizumori and Bryan Kolb. 2) ”Molecular genetics and Biochemistry of learning and memory consolidation” which was led by Jim MeGaugh and Aryeh Routtenberg. 3) ”Behavioral and Neural plasticity in Old Age” which was lead by Michels. Gallagher. 4) ”Drug-induced Sensitization: A Model for Studying Experience-Dependent neuroplasicity” which was led by Terry Robinson. 5) ”Representational and Reorganization as an Adaptive Mechanism of Behavior” which was led by Sheri Mizumori 6) ”Memory Consolidation Revisited with Animal Models” which was lead by Lyn Nadel. 7) ”Interactions of attention with learning and memory” which was lead by Rebecca Burwell. All of the sessions of the conference were well attended and resulted in extensive discussion with each session as well as discussion throughout the conference period. It is hoped that many new ideas were generated as a result of the many excellent presentations and the ensuing discussions.

Author

Conferences; Learning; Memory; Retention (Psychology); Information Processing (Biology)

20000027409 NASA Johnson Space Center, Houston, TX USA

Crew Skills and Training

Jones, Thomas, NASA Johnson Space Center, USA; Burbank, Daniel C., NASA Johnson Space Center, USA; Eppler, Dean, NASA Johnson Space Center, USA; Garrison, Robert, California Univ., USA; Harvey, Ralph, Case Western Reserve Univ., USA; Hoffman, Paul, Harvard Univ., USA; Schmitt, Harrison; Mars Field Geology, Biology. and Paleontology Workshop: Summary and Recommendations; [1998], pp. 25-30; In English; See also 20000027406; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

One of the major focus points for the workshop was the topic of crew skills and training necessary for the Mars surface mission. Discussions centered on the mix of scientific skills necessary to accomplish the proposed scientific goals, and the training environment that can bring the ground and flight teams to readiness. Subsequent discussion resulted in recommendations for specific steps to begin the process of training an experienced Mars exploration team.

Author

Mars Exploration; Mars Surface; Manned Mars Missions; Mars (Planet); Astronauts; Astronaut Training; Qualifications; Mission Planning; Abilities

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..

20000025324 Civil Aeromedical Inst., Oklahoma City, OK USA

Testing the Structural Integrity of the Air Force’s Emergency Passenger Oxygen System at Altitude ***Final Report***

Garner, Robert P., Civil Aeromedical Inst., USA; Murphy, Richard E., Civil Aeromedical Inst., USA; Donnelley, Steve S., Army Test and Evaluation Command, USA; Thompson, Ken E., Army Test and Evaluation Command, USA; Geiwitz, Kevin L., Army Test and Evaluation Command, USA; February 2000; 14p; In English

Report No.(s): DOT/FAA/AM-00/6; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The chemical bond attaching the elastic neck seal to the body of the protective breathing equipment (PBE) procured by the U.S. Air Force as an emergency passenger oxygen System (EPOS) was alleged to be inadequate to allow the PBE to perform as intended at altitude. to test this possibility, EPOS units were collected from Air Force Bases and systematically tested at altitude. The Civil Aeromedical Institute was requested to participate in the testing through the FAA Office of the Inspector General and the U.S. Air Force’s Office of Special Investigations due to the Institute’s longstanding expertise in the area of PBE. Eighty-four of the EPOS units collected were divided into four groups of 21. Since the PBE in question were of relatively recent manufacture,

three of the four groups were artificially aged. Altitude testing was conducted in a hypobaric chamber at a simulated altitude of 40,000 feet above sea level. An EPOS unit from each of the ”aged” groups was placed on one of the four mannequin heads that were instrumented for monitoring pressure, temperature, and atmospheric gas concentrations. The EPOS units were activated at altitude with the primary data collection continuing for a minimum of five minutes after activation. The neck seal/hood interface did not fail on any of the 84 devices during altitude exposure. A destructive test series conducted on an additional 16 EPOS units indicated that an internal pressure approximately six times that observed at altitude was required to result in structural failure of the EPOS units. Based on the data collected in the performance of these tests, the neck seal/hood body interface bond utilized in the construction of these devices is sufficient to allow the PBE to perform as intended at altitude.
Author
Breathing Apparatus; Oxygen Supply Equipment; Passengers; Life Support Systems; Emergency Life Sustaining Systems; Survival Equipment; Destructive Tests

20000025449 Institute for Human Factors TNO, Soesterberg, Netherlands
The Effects of Monocular and Binocular Nightvision Devices on Driving Behaviour and Comfort ***Interim Report De effecten van monoculaire en binoculaire helderheidsversterkers op het rijgedrag en comfort***
VanWinsum, W.; Kooi, F. L.; Nov. 22, 1999; 32p; In Dutch
Report No.(s): AD-A372685; TNO-TM-99-A077; TDCK-TD99-0368; No Copyright; Avail: Defense Technical Information Center (DTIC)

Under contract of the Royal Dutch Army, a field experiment was conducted in which night-time driving with monocular and binocular night vision goggles (NVGs) was tested in rough terrain. The effects of the NVGs was tested on driving behavior and on various aspects of comfort. The results give answer to a number of questions that were raised concerning the optimal configuration of NVGs while driving at night. Drivers are able to drive safely at night with binocular night vision devices, also with a binocular alignment error. No serious problems related to a lack of wearing comfort or visual comfort were found. Driving with a monocular NVG results in equally good performance. However, some of the drivers were not able to complete the two hour session, implying that binocular devices are more suitable for prolonged driving. Also. the visual comfort was rated lower for the monocular NVG.
DTIC
Night Vision; Human Factors Engineering; Monocular Vision; Binocular Vision; Goggles

20000025767 Civil Aeromedical Inst., Oklahoma City, OK USA
The Human Factors Analysis and Classification System-HFACS ***Final Report***
Shappell, Scott A., Civil Aeromedical Inst., USA; Wiegmann, Douglas A., Illinois Univ., USA; February 2000; 22p; In English
Contract(s)/Grant(s): AAM-A-00-HRR-520; 99-G-006
Report No.(s): DOT/FAA/AM-00/7; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Human error has been implicated in 70 to 80% of all civil and military aviation accidents. Yet, most accident reporting systems are not designed around any theoretical framework of human error. As a result, most accident databases are not conducive to a traditional human error analysis, making the identification of intervention strategies onerous. What is required is a general human error framework around which new investigative methods can be designed and existing accident databases restructured. Indeed, a comprehensive human factors analysis and classification system (HFACS) has recently been developed to meet those needs. Specifically, the HFACS framework has been used within the military, commercial, and general aviation sectors to systematically examine underlying human causal factors and to improve aviation accident investigations. This paper describes the development and theoretical underpinnings of HFACS in the hope that it will help safety professionals reduce the aviation accident rate through systematic, data-driven investment strategies and objective evaluation of intervention programs
Author
Aircraft Accident Investigation; Aircraft Accidents; Data Bases; Human Factors Engineering; Human Performance; Pilot Error

20000026305 NASA Johnson Space Center, Houston, TX USA
Evaluation of RME 1318/TVIS Configuration C New ISS Restraint Harness and Modified Subject Load Device (SLD)
Bostick, Laura L., Wyle Labs., Inc., USA; Schmalholz, Don, NASA Johnson Space Center, USA; KC-135 and Other Microgravity Simulations; August 1999, pp. 7-10; In English; See also 20000026303; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Although the treadmill system had flown numerous times on the KC-135 and on the Shuttle, the new Treadmill (TM) Subject Restraint System had not been tested in zero-gravity conditions. The objectives of this investigation were:(1) To evaluate the New ISS Restraint Harness and Modified Subject Load Device (SLD) for physical comfort, stability, and effectiveness for exercise at

different restraint loads; (2) to compare load variance of the modified SLDs which will fly on STS-93 and ISS (cam design) vs. the SLDs which flew on STS-81 and STS-84 (constant-radius hub design); (3) to identify operational constraints with the cam design SLDS.
Author
Harnesses; Treadmills; Weightlessness; Safety Devices

20000026310 NASA Johnson Space Center, Houston, TX USA
Ergonomic Evaluation of the Foot Restraint Equipment Device (FRED)
Whitmore, Mihriban, Lockheed Martin, USA; Chmielewski, Cindy, Lockheed Martin, USA; Qazi, A. S., Lockheed Martin, USA; Mount, Francis, NASA Johnson Space Center, USA; KC-135 and Other Microgravity Simulations; August 1999, pp. 25-30; In English; See also 20000026303; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

Within the scope of the Microgravity Workstation and Restraint Evaluation project, funded by the NASA Headquarters Life Sciences Division, evaluations were proposed to be conducted in ground, KC-135, and/or Shuttle environments to investigate the human factors engineering (HFE) issues concerning confined/unique workstations, including crew restraint requirements. As part of these evaluations, KC-135 flights were conducted to investigate user/ workstation/ restraint integration for microgravity use of the FRED with the RMS workstation. This evaluation was a pre-cursor to Detailed Supplementary Objective (DSO) - 904 on STS-88. On that mission, a small-statured astronaut will be using the FRED restraint while working at the Aft RMS workstation. The DSO will collect video for later posture analyses, as well as subjective data in the form of an electronic questionnaire. This report describes the current FRED KC-135 evaluations. The primary objectives were to evaluate the usability of the FRED and to verify the DSO in-flight setup. The restraint interface evaluation consisted of four basic areas of restraint use: 1) adjustability; 2) general usability and comfort; 3) usability at the RMS workstation; and 4) assembly and disassembly.
Author
Astronauts; Confinement; Human Factors Engineering; Microgravity; Crew Workstations

20000026313 Wyle Labs., Inc., Life Sciences, Houston, TX USA
KC-135 Hardware Evaluation of the HRF Lower Body Negative Pressure Device
Collier, Kevin, Wyle Labs., Inc., USA; Nobmann, Peter, Daimler-Benz Aerospace; KC-135 and Other Microgravity Simulations; August 1999, pp. 48-50; In English; See also 20000026303; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The Lower Body Negative Pressure (LBNP) system is an instrument that encloses the lower body of the test person within a tubular structure and allows the application of a pressure differential inside the system lower than the ambient environment. The pressure differential causes a redistribution of body fluids in the microgravity environment comparable to the fluid distribution that occurs in the upright position in the 1-g environment.
Author
Body Fluids; Lower Body Negative Pressure; Microgravity; Bioastronautics

20000026318 Colorado State Univ., Fort Collins, CO USA
Undergraduate Program Flights: Physiologic Testing of a Constant Force Resistive Exercise Unit in Microgravity
Ruttley, Tara, Colorado State Univ., USA; Colosky, Paul, Jr., Colorado State Univ., USA; Dory, Johnathan, Colorado State Univ., USA; Zenter, Jack, Colorado State Univ., USA; Tong, Timothy, Colorado State Univ., USA; Sutlive, Vinson, Colorado State Univ., USA; KC-135 and Other Microgravity Simulations; August 1999, pp. 73-79; In English; See also 20000026303; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

As the future of the space program promises long-term exploration missions, lunar habitation, and the building of the space station, production of reliable countermeasures for muscle atrophy and bone calcium loss in microgravity has become increasingly essential. Since typical weight stacks are useless in microgravity, a similar means by which to provide constant force during eccentric and concentric contraction is necessary during exercise. The KC-135 flight provided a valuable means by which to validate the Modified Constant Force Resistive Exercise Unit (CFREU-A) and the unique force pack design in microgravity. SEMG data reflected real-time muscle response during in-flight and ground-based exercise, and force gauge readings validated the constant force capabilities of the constant torque springs within each uniquely designed force pack. As we expected, SEMG data and force gauge data indicate that the force packs within the CFREU-A performed as well as the weight stacks on the Cybex unit, both in microgravity and on the ground. The constant torque springs within each force pack maintained their resistance level and a constant force over the entire range of each exercise. SEMG data concerning concentric and eccentric contractions further

validated the force packs within the CFREU-A as a means by which to obtain an effective strengthening routine both in microgravity and on the ground.
Derived from text
Countermeasures; Microgravity; Muscular Function; Physical Exercise; Bioastronautics

20000026327 Longview High School, Longview, TX USA
"Fly High" Program: Human Interface Demonstration
Grubbs, Amanda, Longview High School, USA; Mayes, Jason, Longview High School, USA; Lawson, Bryan, Longview High School, USA; Welge, Kirsten, Longview High School, USA; Robinett, Don, Longview High School, USA; Pope, Ruth Ann, Longview High School, USA; Moore, Alicia, Longview High School, USA; Shivers, Suzette, Longview High School, USA; Beene, Rachel, Longview High School, USA; Zountendam, Michel, Longview High School, USA; KC-135 and Other Microgravity Simulations; August 1999, pp. 117-120; In English; See also 20000026303; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The goal of this experiment was to determine which of the four Interface Control Devices (ICDs) performed the best in a zero-G environment, based on accuracy maneuverability, and comfort. The objective of the flight tests in the KC-135 and the ground tests in the X-38/CRV Remote Cockpit Van were to evaluate the four different ICDS: Smart Cat Touchpad, NEcrosoft SideWinder 3D-Pro Joystick, Microsoft SideWinder Gamepad, and the Logitech Trackman Marble (Optical Trackball). The major design issues that were addressed during this experiment were the ability to maneuver the ICDS, how easily they handled blind operations, and comfort in micro-gravity.
Author
Control Equipment; Maneuverability; Microgravity; Weightlessness; Spacecraft Control; Indicating Instruments

20000026330 Van Alstyne High School, Van Alstyne, TX USA
"Fly High" Program: Night Cap Monitor
Dobbins, Miriam, Van Alstyne High School, USA; Dyer, Rusty, Van Alstyne High School, USA; Haddox, Ashley, Van Alstyne High School, USA; Potter, Heather, Van Alstyne High School, USA; Taylor, Erin, Van Alstyne High School, USA; Taylor, Daniel, Van Alstyne High School, USA; Sauer, Lizabeth, Van Alstyne High School, USA; Butcher, Toni, Van Alstyne High School, USA; Powers, Whitney, Van Alstyne High School, USA; Mosca, Jessica, Van Alstyne High School, USA; KC-135 and Other Microgravity Simulations; August 1999, pp. 128-133; In English; See also 20000026303; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

The goals of this investigation are to measure head motion during micro-gravity in duplication of an experiment aboard the Mir, to make the accelerometer more comfortable, and to make sure the accelerometer works in microgravity conditions
CASI
Accelerometers; Microgravity; Head Movement

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.

20000025773 Royal Inst. of Tech., Dept. of Mathematics, Stockholm, Sweden
Littlewood-Paley Inequality for the Carleson Operator
Prestini, E.; Sjoelin, P.; Oct. 1999; 18p; In English
Report No.(s): PB2000-102712; TRITA-MAT-1999-18; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

No abstract available.
NTIS
Inequalities; Measure and Integration

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.

20000025586 Nippon Telegraph and Telephone Public Corp., Basic Research Labs., Tokyo, Japan
From Quantum Effects to Quantum Circuits: Toward the Quantum Computer
Takayanagi, Hideaki, Nippon Telegraph and Telephone Public Corp., Japan; Ando, Hiroaki, Nippon Telegraph and Telephone Public Corp., Japan; Fujisawa, Toshimasa, Nippon Telegraph and Telephone Public Corp., Japan; NTT Review; January 2000; Volume 12, No. 1, pp. 17-25; In English; See also 20000025584; Copyright; Avail: Issuing Activity

The quantum computer is designed to harness the unique uncertainties of quantum mechanics at the micro level to enable ultra-rapid calculations at hitherto unimaginable speeds. In this article, we describe the progress of research from the quantum effect to quantum gate circuits and the quantum computer, citing three research fields at the NTT Basic Research Laboratories - quantum dot molecules, optical quantum dots and superconducting loops.
Author
Quantum Mechanics; Parallel Processing (Computers); Quantum Dots

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.

20000025340 Army Research Inst. of Environmental Medicine, Natick, MA USA
CIRCAD: Automated Analysis of Circadian Core Temperature Data
Doherty, Tammy J.; Coyne, Mary D.; Kesick, Christina M.; Stephenson, Lou A; Jan. 2000; 53p; In English
Report No.(s): AD-A372290; TN-00/2; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

No accepted methodologies exist to study day-to-day changes in the characteristics of the circadian rhythm. Testing different methodologies using data processing and curve-fitting functions within Microsoft Excel and Jandel Sigmaplot is prohibitively expensive in terms of both time and personnel. Use of the CIRCAD program, described in this report, dramatically reduces the amount of time required for circadian data analyses and provides the capability to quickly implement and test new analytical methods. This Technical Note includes a brief description of the software, complete program listings in the appendices, and sample input and output including both worksheet samplers and graphs.
DTIC
Circadian Rhythms; Curve Fitting; Data Reduction; Data Processing

20000025389 NASA Langley Research Center, Hampton, VA USA
Comparison of Integrated Analysis Methods for Two Model Scenarios
Amundsen, Ruth M., NASA Langley Research Center, USA; Ninth Thermal and Fluids Analysis Workshop Proceedings; November 1999, pp. 37-48; In English; See also 20000025387; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Integrated analysis methods have the potential to substantially decrease the time required for analysis modeling. Integration with computer aided design (CAD) software can also allow a model to be more accurate by facilitating import of exact design geometry. However, the integrated method utilized must sometimes be tailored to the specific modeling situation, in order to make the process most efficient. Two cases are presented here that illustrate different processes used for thermal analysis on two different models. These examples are used to illustrate how the requirements, available input, expected output, and tools available all affect the process selected by the analyst for the most efficient and effective analysis.
Author
Computer Aided Design; Systems Integration; Applications Programs (Computers); Aircraft Models; Hypersonic Aircraft

20000025401 Cullimore and Ring Technologies, Inc., Littleton, CO USA
True Concurrent Thermal Engineering Integrating CAD Model Building with Finite Element and Finite Difference Methods
Panczak, Tim, Cullimore and Ring Technologies, Inc., USA; Ring, Steve, Cullimore and Ring Technologies, Inc., USA; Welch, Mark, Cullimore and Ring Technologies, Inc., USA; Ninth Thermal and Fluids Analysis Workshop Proceedings; November 1999,

pp. 217-232; In English; See also 20000025387; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Thermal engineering has long been left out of the concurrent engineering environment dominated by CAD (computer aided design) and FEM (finite element method) software. Current tools attempt to force the thermal design process into an environment primarily created to support structural analysis, which results in inappropriate thermal models. As a result, many thermal engineers either build models ”by hand” or use geometric user interfaces that are separate from and have little useful connection, if any, to CAD and FEM systems. This paper describes the development of a new thermal design environment called the Thermal Desktop. This system, while fully integrated into a neutral, low cost CAD system, and which utilizes both FEM and FD methods, does not compromise the needs of the thermal engineer. Rather, the features needed for concurrent thermal analysis are specifically addressed by combining traditional parametric surface based radiation and FD based conduction modeling with CAD and FEM methods. The use of flexible and familiar temperature solvers such as SINDA/FLUINT (Systems Improved Numerical Differencing Analyzer/Fluid Integrator) is retained.

Author

Computer Aided Design; Systems Integration; Finite Difference Theory; Concurrent Engineering; Thermal Analysis; Finite Element Method

20000025403 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Integrating Thermal Tools Into the Mechanical Design Process

Tsuyuki, Glenn T., Jet Propulsion Lab., California Inst. of Tech., USA; Siebes, Georg, Jet Propulsion Lab., California Inst. of Tech., USA; Novak, Keith S., Jet Propulsion Lab., California Inst. of Tech., USA; Kinsella, Gary M., Jet Propulsion Lab., California Inst. of Tech., USA; Ninth Thermal and Fluids Analysis Workshop Proceedings; November 1999, pp. 239-249; In English; See also 20000025387; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The intent of mechanical design is to deliver a hardware product that meets or exceeds customer expectations, while reducing cycle time and cost. To this end, an integrated mechanical design process enables the idea of parallel development (concurrent engineering). This represents a shift from the traditional mechanical design process. With such a concurrent process, there are significant issues that have to be identified and addressed before re-engineering the mechanical design process to facilitate concurrent engineering. These issues also assist in the integration and re-engineering of the thermal design sub-process since it resides within the entire mechanical design process. With these issues in mind, a thermal design sub-process can be re-defined in a manner that has a higher probability of acceptance, thus enabling an integrated mechanical design process. However, the actual implementation is not always problem-free. Experience in applying the thermal design sub-process to actual situations provides the evidence for improvement, but more importantly, for judging the viability and feasibility of the sub-process.

Author

Concurrent Engineering; Systems Integration; Mechanical Engineering; Computer Aided Design; Thermal Analysis

20000025405 Opto-Mech Interface Organization, Boulder, CO USA

A Short History and a Bright Future for Opto-Mechanical Interface

Wise, Timothy D., Opto-Mech Interface Organization, USA; Ninth Thermal and Fluids Analysis Workshop Proceedings; November 1999, pp. 263-270; In English; See also 20000025387; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Just thirteen years ago several key aerospace companies, among them Hughes Aircraft, recognized the need to pass data between the optical and mechanical design environments more efficiently. Up to that time it was common to wheel a stack of computer printout, two feet deep, into the mechanical designer’s office for the purpose of describing the clear aperture requirements along the optical train and the connecting ray-path volumes that were not to be invaded by mechanical mounts. The contents of the ”stack” were page after page of ray-surface intersection coordinates that the mechanical designer had to meticulously load into his CAD model. No wonder the relations between optical and mechanical designers were strained, at best. The change that occurred around 1985 was the development of the first few translators that automated the transfer of optical ray data. In particular, Hughes Aircraft presented a key paper at the 1986 SPIE conference in Innsbruck/Austria, which described a translator that wrote optics/ray-data from the CODE-VTM optical design program to IGES format, for input to the ANVIL mechanical drafting program. This touchstone accomplishment represented the first of a whole stable of translators that were created to provide fast and accurate interfaces among many CAD programs. Unfortunately, therein lay the problem with this approach: the possible permutations of interfaces among, say, a half dozen CAD software packages multiplied out to 36 individual translators, all of which have to be updated as the CAD packages are revised. and this was just within one company. The number of possible permutations becomes even more ridiculous if one attempts to share data between companies. Therefore, it became clear as early as 1988 that a simpler approach was needed to port optical data into a variety of CAD environments. Starting in that year was an effort to create an international standard called NODIF, the Neutral Optical Data Interchange Format, which was to be implemented in the pre- and post-processors of a variety of CAD packages. By 1993 it was decided that NODIF should become

part of the much larger STandard for the Exchange of Product model data (STEP). Then in 1995 a working group within the International Organization for Standardization (ISO) was formed to ”make it so”. Now 3 years later, it is appropriate that we review where we stand in this effort, demonstrate what we’ve accomplished so far and describe the bright future that awaits us. As we carry this out in the remainder of this paper, there may be some useful concepts for those of you working in the myriad of fields that may be tangent to optics and mechanics.
Author
Computer Aided Design; Applications Programs (Computers); Optical Equipment; Mechanical Devices; Mechanical Engineering; Aerospace Industry; Design Analysis

20000025432 General Accounting Office, Accounting and Information Management Div., Washington, DC USA
Year 2000 Computing Crisis: Strong Leadership and Partnerships Needed to Mitigate Risk of Major Disruptions. Statement of Joel C. Willemssen, Director, Civil Agencies Information Systems, Accounting and Information Management Division
Aug. 13, 1998; 24p; In English
Report No.(s): PB2000-101846; GAO/T-AIMD-98-262; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The author briefly discusses the Year 2000 risks facing the nation, highlight our major concerns with the federal government’s progress in correcting its systems, identify state and local government Year 2000 issues, and discusses critical year 2000 data exchange issue.
NTIS
Risk; Governments; Progress; Correction; Computer Programming; Coding; Software Engineering

20000025473 Rutherford Appleton Lab., Chilton, UK
Open Genie Reference Manual, 2.0
Akeroyd, F. A., Rutherford Appleton Lab., UK; Ashworth, R. L., Rutherford Appleton Lab., UK; Campbell, S. I., Rutherford Appleton Lab., UK; Johnston, S. D., Rutherford Appleton Lab., UK; Moreton–Smith, C. M., Rutherford Appleton Lab., UK; Sergeant, R. G., Rutherford Appleton Lab., UK; Sivia, D. S., Rutherford Appleton Lab., UK; Jan. 07, 2000; ISSN 1358-6254; 316p; In English
Report No.(s): RAL-TR-1999-031; Copyright; Avail: Issuing Activity
Open GENIE commands fall into two obvious groupings, those used primarily in interactive mode and which are complete within a single line, and those used mainly to build procedures and whose effect spans several lines. The former are termed ”single-line’ and the latter ”multi-line” commands. Single line commands also fall into a further division between commands which are expressed in an algebraic or functional notation and commands which are accessed as a simple keyword type command: Micro-syntax (some preliminaries about open GENIE syntax). Single-line commands. Multi-line commands.
Author
Computer Programs; Language Programming

20000025552 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
The Integrated Multi-Objective Multi-Disciplinary Jet Engine Design Optimization Program ***Final Report, Mar. 1997 - Dec. 1998***
Kuprowicz, Nicholas J.; Jan. 1999; 82p; In English
Contract(s)/Grant(s): Proj-3066
Report No.(s): AD-A372032; AFRL-PR-WP-TR-1999-2028; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
The integrated multi-objective multi-disciplinary jet engine design optimization program is an analysis tool to aid engineers in the conceptual engine design process. The program allows performance evaluation of a specified engine or a specified aircraft/engine combination at given operating conditions or over a given mission. In addition, the program allows the selection of values for specified engine parameters that yield the best composite performance at one or more operating conditions or over a given mission. Finally, the program utilizes multi-objective optimization techniques to simultaneously address conflicting objectives such as maximizing performance and minimizing fuel use, size, and cost. This report is primarily a software use’s guide to provide instruction on using the Integrated Multi-Objective Multi-Disciplinary Jet Engine Design Optimization Program. The genetic algorithm routines used in the program are based on an existing public domain package. The aircraft design program is based on a AIAA sponsored code. The engine performance program is a proprietary DoD limited code.
DTIC
Design Analysis; Engine Design; Multidisciplinary Design Optimization; Computer Aided Design; Software Development Tools

20000025579 Research Inst. of National Defence, Dept. of Command and Control Warfare Technology, Linkoeping, Sweden
General Method of Simulation of Electro-Optical Electronic Warfare Duels ***Generell Metod foer Simulering av Elektro-Optiska Telekrigdueller***
Hedberg, C.; Tyden, L.; Wigren, C.; Jun. 1999; 40p; In Swedish; Original contains color illustrations
Report No.(s): PB2000-103051; FOA-R-99-01160-616-SE; No Copyright; Avail: National Technical Information Service (NTIS)

This report describes a method for simulation of electro-optical duels. The method uses the program OPTSIM. The report describes the handling of OPTSIM and a number of models that has been adapted to communicate with OPTSIM. The models that exist today handles background, objects, atmosphere, countermeasures, sensors, seekers and trackers. The program structure dynamically built so that future demands can be met by adding new modules to the OPTSIM-package.
NTIS
Electro-Optics; Electronic Warfare; Computerized Simulation

20000025582 Data and Analysis Center for Software, Griffiss AFB, NY USA
Software Tech News. The DoD Source for Software Technology Information: Software Testing Series, Part 2
Borgia, William M.; Hrdlick, Neil J.; Jan. 1999; 24p; In English
Report No.(s): AD-A371840; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Software Tech News is a publication of the DoD Data & Analysis Center for Software (DACS). The DACS is a DTIC Sponsored Information Analysis Center (IAC) and the DoD Software Information Clearinghouse. The DACS is operated by ITT Industries, Systems Division and technically managed by Air Force Research Laboratory - Information Directorate (AFRL/IF). In this issue: Testing software based systems, Survivability as a component of software metrics, Task-based software testing, Thread-based integration testing, Software testing, and DACs Products and order forms.
DTIC
Software Engineering; Program Verification (Computers); Research Management

20000025590 Nippon Telegraph and Telephone Public Corp., Research and Development Center, Tokyo, Japan
Trends in Software Engineering Standardization: Activity Report of ISO/IEC/JTC1/SC7 and Curitiba Meeting Report
Nishiyama, Shigeru, Nippon Telegraph and Telephone Public Corp., Japan; NTT Review; January 2000; Volume 12, No. 1, pp. 55-57; In English; See also 20000025584; Copyright; Avail: Issuing Activity

This article describes the activities of SC7 and its working groups (WG), which have been studying the standardization of software engineering jointly by ISO (International Organization for Standardization) and IEC (International Electrotechnical Commission), and reports on the 12th Plenary Meeting held last year. It also introduces domestic activities related to these global standardization activities.
Author
Software Engineering; Computer Programming; Trends; Standardization

20000026825 Rutherford Appleton Lab., Chilton, UK
The ISIS Open GENIE User Manual, 1.1
Akeroyd, F. A., Rutherford Appleton Lab., UK; Ashworth, R. L., Rutherford Appleton Lab., UK; Campbell, S. I., Rutherford Appleton Lab., UK; Johnston, S. D., Rutherford Appleton Lab., UK; Martin, J. M., Rutherford Appleton Lab., UK; Moreton–Smith, C. M., Rutherford Appleton Lab., UK; Sivia, D. S., Rutherford Appleton Lab., UK; Jan. 27, 2000; ISSN 1358-6254; 76p; In English
Report No.(s): RAL-TR-2000-002; Copyright; Avail: Issuing Activity

GENIE is the name of a programs used for the display and analysis of data from the neutron scattering instruments at the ISIS (Introduction Status Instruments Search) facility. For several years now, a stable VAX/VMS version of the software (GENIE-V2) has been in use at ISIS (Rutherford Appleton Laboratory, Oxfordshire, UK), and at several scientific and commercial establishments world-wide. Constant improvements in the capabilities of the neutron scattering instruments at ISIS, and in the hardware and software available for data analysis, has necessitated a re-write of GENIE. The new GENIE is known as Open GENIE to reflect the intention that the software be used on a wide variety of different computers and operating systems. It is aimed at supplying scientists with an inexpensive computer package which provides them with access to their experimental data, so that they may analyse the data as required and display the results in a useful format, usually in a graphical form.
Derived from text
User Manuals (Computer Programs); Applications Programs (Computers); Data Processing; Graphical User Interface

20000027425 Technion - Israel Inst. of Tech., Haifa, Israel

Computer-Assisted Planning of an Aerobatic Sequence

Iosilevskii, G., Technion - Israel Inst. of Tech., Israel; Shafir, Y., Elbit Systems Ltd., Israel; 1999 Report to the Aerospace Profession: Forty Third Symposium Proceedings; September 1999, pp. 145-153; In English; See also 20000027414; Copyright; Avail: Issuing Activity

This paper discusses considerations developed by the Air Force Flight Test Center test system safety process for assessing the risk associated with testing ground collision avoidance systems (GCAS). It specifically discusses available reaction time (A.R.T.) as a tool used to assess the risk of test points flown by the F-16 Combined Test Force at Edwards Air Force Base, California, during Digital Terrain System (DTS) developmental test and evaluation. The A.R.T. system uses time to ground impact as a normalizing factor to define the risk associated with flying any given GCAS test point. The numerous risk factors associated with GCAS testing and the necessary assumptions required to conduct such testing safely are also discussed. The initial results of the DTS testing that affected the A.R.T. based risk assessment are presented along with how the risk assessment was changed based on the lessons learned about pilot reaction times and pilot comfort level. Overall, the paper emphasizes basic principles that apply to conducting GCAS testing in any type of aircraft from fighters to transports.

Derived from text

Computer Techniques; Planning; Sequencing; Aerobatics; Flight Control; Maneuvers; Flight Tests; Risk; Assessments

20000027533 North Carolina Univ., Dept. of Environmental Sciences and Engineering, Chapel Hill, NC USA

Bayesian Maximum Entropy Analysis and Mapping: A Farewell to Kriging Estimators?

Christakos, George, North Carolina Univ., USA; Li, Xinyang, North Carolina Univ., USA; Mathematical Geology; 1998; ISSN 0882-8121; Volume 30, No. 4, pp. 435-450; In English

Contract(s)/Grant(s): DAAL03-92-G-0111

Report No.(s): AD-A369922; ARO-30377.60-EV-URI; Copyright; Avail: Issuing Activity, Hardcopy

The Bayesian Maximum Entropy (BME) method of spatial analysis and mapping provides definite rules for incorporating prior information hard and soft data into (he mapping process. It has certain unique features that make it a loyal guardian of plausible reasoning under conditions of uncertainty. BME is a general approach that does not make any assumptions regarding the linearity of the estimator, the normality of the underlying probability laws, or the homogeneity of the spatial distribution. by capitalizing on various sources of information and data, BME introduces an epistemological framework that produces predictive maps that are more accurate and in many cases computationally more efficient than those derived by traditional techniques. In fact, kriging techniques can be derived as special cases of the BME approach, under restrictive assumptions regarding the prior information and the data available. BME is a more rigorous approach than indicator kriging for incorporating soft data. The BME formulation, in fact, applies in a spatial or a spatiotemporal domain and its extension to the case of block and vector random fields is straightforward. New theoretical results are presented and numerical examples are discussed, which use the BME approach to account for important sources of knowledge in a systematic manner. BME can be useful in practical situations in which prior information can be used to compensate for the limited amount of measurements available (e.g., preliminary or feasibility study levels) or soft data are available that can be combined with hard data to improve mapping significantly. BME may be then viewed as an effort towards the development of a more general framework of spatial/temporal analysis and mapping. which includes traditional geostatistics as its limiting case, and it also provides the means to derive novel results that could not be obtained by traditional geostatistics.

Author

Bayes Theorem; Maximum Entropy Method; Spatial Distribution; Geology; Mapping

20000027600 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA

The True Limitations of Shared Memory Programming ***Final Report, 1996***

Pressel, D. M.; Behr, M.; Thompson, S.; Jan. 2000; 31p; In English; Prepared in cooperation with the University of Minnesota, Minneapolis, MN 55415, and Raytheon Systems Co. Aberdeen, MD 21001.

Report No.(s): AD-A373358; ARL-TR-2147; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Shared memory parallel computers have the reputation for being the easiest type of parallel computers to program. At the same time, they are frequently regarded as being the least scalable type of parallel computer. In particular, shared memory parallel computers are frequently programmed using a form of loop-level parallelism (usually based on some combination of compiler directives and automatic parallelization). However, in discussing this form of parallelism, the experts in the field routinely say that it will not scale past 4-16 processors (the number varies among experts). This report investigates what the true limitations

are to this type of parallel programming. The discussions are largely based on the experiences that the authors had in porting the Implicit Computational Fluid Dynamics Code (F3D) to numerous shared memory systems from SGI, Cray, and Convex.
DTIC
Computer Programming; Parallel Programming; Parallel Computers

20000027613 Naval Postgraduate School, Monterey, CA USA
Computer-Aided Software Evolution Based on Inferred Dependencies
Harn, Meng–Chyi; Dec. 1999; 519p; In English
Report No.(s): AD-A372890; No Copyright; Avail: CASI; A22, Hardcopy; A04, Microfiche

The major problem addressed by this research is how to automate parts of software evolution using dependency rules, especially for large and complex real time embedded systems. The main topics of this study are the development of a Relational Hypergraph model (RH model) and the design of a Computer Aided Software Evolution System (CASES). The goals of this dissertation are to explore the existing issues, to formalize software evolution, to reuse software evolution components, and to build a dependency computing model. We have resolved parts of essential software evolution issues in the following categories: software evolution process, software evolution traceability, software evolution description, software evolution management, and software evolution control. The RH model can realize automated software evolution in multi-dimensional phases, such as software prototype or product demo, issue analysis, requirement analysis, specification design, module implementation, program integration, and software product implementation. Many types of software evolution objects in each phase, and dependencies among these objects have been defined to describe software evolution processes.
DTIC
Computer Aided Design; Computer Systems Programs

20000027615 Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA
Builder's Guide for WaterBeans Components
Plakosh, Daniel; Smith, Dennis; Wallnau, Kurt C.; Dec. 1999; 50p; In English
Contract(s)/Grant(s): F19628-95-C-0003
Report No.(s): AD-A373154; CMU/SEI-99-TR-024; ESC-TR-99-024; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

WaterBeans is a proof-of-feasibility system for building software applications through a process of assembling (composing) prefabricated software components. WaterBeans was originally developed as a proof of feasibility that software component technology could be used to develop software applications in the domain of water-quality modeling. (In particular, WaterBeans supports modeling and simulating the hydrology of urban storm water sewage and runoff.) WaterBeans includes a component model for component developers, a visual composition environment for importing and assembling components into applications, and several families of components. One family of components supports modeling and simulating urban sewage systems. Another family of components was developed to prove the generality of WaterBeans; this family of components allows visualization and manipulation of digital waveforms. This report documents the programming interface for component developers. It also provides a brief description of the composition environment.
DTIC
Software Engineering; Computer Programming; Waveforms

20000027629 National Defense Industrial Association, Arlington, VA USA
Interservice/Industry Training, Simulation and Conference. Abstracts
Dec. 02, 1999; 179p; In English
Report No.(s): AD-A373368; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

This report contains abstracts of papers presented at the Interservice / Industry Training, Simulation and Education Conference held in Orlando, Florida on 28 Nov-2 Dec 99, at the Orange County Convention Center.
DTIC
Abstracts; Education

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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.

20000025494 Mercury Computer Systems, Inc., Chelmsford, MA USA
Bridging the Development Gap ***Final Report, Sep. 1995 - Sep. 1997***
Lund, Craig; Nov. 1999; 67p; In English
Contract(s)/Grant(s): F30602-95-2-0037; AF Proj. D002
Report No.(s): AD-A372422; AFRL-IF-RS-TR-1999-241; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Bridging the Development Gap is contractual cooperative agreement between Mercury Computer Systems, Inc. and DARPA. This program was developed because a software gap exists between the workstation-based research phase of a signal processing project and the more contained prototyping phase. The transition requires a shift from a workstations rich environment into an embedded system that typically offers only basic system software. The gap reflects more than just a lack of software tools. It concerns new challenges such as: parallel decomposition, optimizing data transfer, heterogeneous processing, interfacing with I/O devices, memory constraints, as well as real-time throughput and latency challenges. Mercury has bridged the indicated software gap by delivering on this program a deployment-focused environment for algorithms created in a popular research language, MATLAB (and its companion SIMULINK). The project has had the full cooperation of The Math Works, owner of MATLAB and SIMULINK. Mercury's discussions with Prime Contractors building large, embedded systems had shown MATLAB to be nearly universal tool of choice within the research phase of these projects. Demand for a MATLAB deployment path thus clearly existed. The most significant element required to pull MATLAB and SIMULINK into parallel processing is to create a "mapping tool" and an underlying "component" run-time system.
DTIC
Algorithms; Computer Networks; Computer Programs; Software Engineering

20000025545 Naval Postgraduate School, Monterey, CA USA
A Network Design Architecture for Distribution of Generic Scene Graphs
Fiambolis, Panagiotis; Prolopakis, Georgios; Sep. 1999; 165p; In English
Report No.(s): AD-A371846; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Sharing a common view while collaborating in networked virtual environments is complex. The SOFT project examines a new approach: using generic scene graphs as a bus, for graphics distribution. This thesis (as part of the SOFT project) examines network architecture for distribution of generic scene graphs. We design and implement the network architecture with a centralized Java server. This server provides scalability, persistence, reliability, and late comer support. The server provides interoperability and can support any SSGs on any platform. The extraction of information from the network layer is implemented in two ways. In the first, we use Java's inherent serialization mechanisms; in the second, we use the Dial a Behavior (DaBP) protocol. We empirically test the server's overhead with both network mechanisms. We have concluded that using DaBP significantly reduces the server's overhead by a factor of six but only for less than 50,000 packets. Moreover, the use of DaBP provides implementation flexibility because data format can change dynamically without requiring recompilation. Finally, DaBP, while promising, must mature and be shown to reduce overhead for large number of packets before it is ready to be incorporated into the final architecture solution for SOFT.
DTIC
Architecture (Computers); Computer Graphics; Client Server Systems

20000026833 Architectural and Transportation Barriers Compliance Board, Washington, DC USA
Electronic and Information Technology Access Advisory Committee ***Final Report***
May 12, 1999; 38p; In English
Report No.(s): PB2000-102314; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The Workforce Investment Act of 1998, signed into law on August 7, 1998, contains amendments to the Rehabilitation Act of 1973. The changes to Section 508 of the 1998 amendments to the Rehabilitation Act were designed to strengthen current law to ensure that people with disabilities will have quity in the use of electronic and information technology (E&IT). When Federal departments or agencies develop, procure, maintain, or use electronic and information technology, they shall ensure that the electronic and information technology allows Federal employees with disabilities to have access to and use of information and data that is comparable to the access to and use of information and data by Federal employees who are not individuals with disabilities, unless an undue burden would be imposed on the department or agency. The purpose of this report is to provide a set

of recommended standards for Federal procurement officers and commercial suppliers of electronic and information technology and services that will result in access to and use of the technology and information by individuals with disabilities. This report represents minimally acceptable standards. All entities involved in the design, production, and procurement process of relevant electronic and information technology are strongly encouraged to go beyond these standards to maximize the accessibility and usability of products by all individuals.
NTIS
Disabilities; Electronics; Information Management; Procurement; Government Procurement

20000026838 Australian National Univ., Canberra Australia
Tbit/s Optical Packet Processing using the Resonant Soliton Logic Gates ***Final Report, 14 Apr. - 13 Dec. 1999***
Talanina, Irina, Australian National Univ., Australia; Jan. 05, 2000; 28p; In English
Contract(s)/Grant(s): F62562-99-M-9105
Report No.(s): AD-A372515; AOARD-994002; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Optical packet processing is emerging as one of the key technologies for implementation of future ultra high-speed and multi-functional TDM networks. An essential element of these networks is a receiver node with functionalities which include packet address recognition, packet routing, buffering and rate conversion. In this research program, a possibility of Tbit/s optical packet processing in a TDFM receiver node using the resonant solition switches and logic gates has been demonstrated. The address recognition function for incoming optical packets has been performed numerically at 2 Tbit/s and 200 Gbit/s data rates. Buffering of optical packets to produce multiple copies of the inputs has been modelled using 3 x 3 nonlinear directional coupler configuration; the simulations have been performed at two different data rates; 3 Tbit/s and 500 Gbit/s. A simple scheme to upconvert the repetition rate of an optical clock stream has been proposed, and the repetition rate multiplication from 250 Gbit/s to 1 Tbit/s has been demonstrated. A possible scheme to achieve the data rate down-conversion in the case of optical packets of arbitrary format has been described. The examples of demultiplexing of optical clock streams and optical packets at 3 Tbit/s have been presented. The operating characteristics of the components in the receiver node have been assessed. to our knowledge, this is the first demonstration of the possibility of optical packet processing at Tbit/s data rates.
DTIC
Nonlinear Optics; Time Division Multiplexing; Computer Networks; Packets (Communication)

20000026842 Committee on Aeronautical and Space Sciences (U.S. Senate), Washington, DC USA
Investigating the Impact of the Year 2000 Problem: Summary of the Committee's Work in the 105th Congress
Dodd, Christopher J., Committee on Aeronautical and Space Sciences (U.S. Senate), USA; Bennett, Robert F., Committee on Aeronautical and Space Sciences (U.S. Senate), USA; Feb. 24, 1999; 159p; In English
Report No.(s): AD-A372534; S-PRT-106-10; No Copyright; Avail: CASI; A02, Microfiche; A08, Hardcopy

The Committee has found that the most frustrating aspect of addressing the Year 2000 (Y2K) problem is sorting fact from fiction. Reports from even the most reputable news sources fall prey to polarizing forces either over emphasizing a handful of Y2K survivalists, or down-playing the event as a hoax designed to sell information technology equipment. The Internet surges with rumors of massive Y2K test failures that turn out to be gross misstatements, while image-sensitive corporations down- play real Y2K problems. The good news is that talk of the death of civilization, to borrow from Mark Twain, has been greatly exaggerated. The bad news is that Committee research has concluded that the Y2K problem is very real and that Y2K risk management efforts must be increased to avert serious disruptions.
DTIC
Computer Program Integrity; Software Engineering; Information Systems

20000027560 NASA Goddard Space Flight Center, Greenbelt, MD USA
An Efficient Objective Analysis System for Parallel Computers
Stobie, James G., NASA Goddard Space Flight Center, USA; [1999]; In English; 24th General Assembly EGS, 19-23 Apr. 1999, The Hague, Netherlands; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

A new objective analysis system designed for parallel computers will be described. The system can produce a global analysis (on a 2 x 2.5 lat-lon grid with 20 levels of heights and winds and 10 levels of moisture) using 120,000 observations in less than 3 minutes on 32 CPUs (SGI Origin 2000). No special parallel code is needed (e.g. MPI or multitasking) and the 32 CPUs do not have to be on the same platform. The system Ls totally portable and can run on -several different architectures at once. In addition, the system can easily scale up to 100 or more CPUS. This will allow for much higher resolution and significant increases in input data. The system scales linearly as the number of observations and the number of grid points. The cost overhead in going from I to 32 CPus is 18%. in addition, the analysis results are identical regardless of the number of processors used. T'his system has

all the characteristics of optimal interpolation, combining detailed instrument and first guess error statistics to produce the best estimate of the atmospheric state. It also includes a new quality control (buddy check) system. Static tests with the system showed it's analysis increments are comparable to the latest NASA operational system including maintenance of mass-wind balance. Results from a 2-month cycling test in the Goddard EOS Data Assimilation System (GEOS DAS) show this new analysis retains the same level of agreement between the first guess and observations (0-F statistics) throughout the entire two months.
Author
Assimilation; Computational Grids; Data Systems; Mass Distribution; Parallel Computers

63
CYBERNETICS, ARTIFICIAL INTELLIGENCE AND ROBOTICS

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

20000025470 Trinity Coll., Dublin Ireland
1st International Workshop on Managing Interactions in Smart Environments (MANSE 1999)
Nixon, Paddy, Editor; Lacey, Gerard, Editor; Dobson, Simon, Editor; Dec. 1999; 259p; In English; 1st; Managing Interactions in Smart Environments, 13-14 Dec. 1999, Dublin, Ireland
Report No.(s): AD-A372438; EOARD-CSP-00-5004; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

The Final Proceedings for 1st International Workshop on Managing Interactions in Smart Environments (MANSE 99), 13 December 1999 - 14 December 1999. This is an interdisciplinary conference. The conference will address the convergence of research in Distributed Systems, Robotics and Human Centered Computing within the domain of smart buildings and present a unique opportunity to investigate work that crosses the boundaries of these disciplines.
DTIC
Conferences; Human Factors Engineering; Knowledge Based Systems; Robotics; Virtual Reality

20000026821 National Inst. of Standards and Technology, Manufacturing Engineering Lab., Gaithersburg, MD USA
Formalizing the NIST 4-D/RCS Reference Model Architecture Using an Architectural Description Language
Dabrowski, C.; Huang, H.; Messina, E.; Horst, J.; Dec. 1999; 76p; In English
Report No.(s): PB2000-102852; NISTIR-6443; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The 4-D/Real-Time Control System (RCS) Reference Model Architecture provides a well-defined strategy for development of software components for applications in robotics, automated manufacturing, and autonomous vehicles. To further this work, an investigation has been conducted into the use of Architectural Description Languages (ADLs) as a means to provide a more formal, rigorous definition of the 4;D/RCS Reference Model Architecture and to specify software components for 4-D/RCS systems. In this report, we describe the results of an investigation into the use of ADLs to specify 4-D/RCS software systems, and assess the potential value of ADLs as specification and development tools for RCS domain experts. We conclude that ADLs not only can be used successfully to specify the 4-D/RCS Reference Model, but that they also serve as effective tools to enhance and extend this model. We also find that ADLs potentially can provide a formal basis for automatically checking the consistency of architecture specifications and verifying designs of RCS-based systems against the standardized 4-D/RCS Reference Model. The report discusses prospects for automated reuse of components specified with an ADL, and makes recommendations on improving ADLs as effective tools for specifying, communicating, and validating 4-d/RCS system designs and software components. Finally, the report discusses potential influence of ADLs for commercial software development tools and provides future directions for research.
NTIS
Architecture (Computers); Computer Programming; Software Development Tools; Software Engineering; Software Reliability; Program Verification (Computers)

20000027601 Carnegie-Mellon Univ., Dept. of Computer Science, Pittsburgh, PA USA
Classifying Adversarial Behaviors in a Dynamic Inaccessible Multi-Agent Environment
Riley, Patrick; Nov. 1999; 16p; In English
Report No.(s): AD-A373345; CMU-CS-99-175; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Developing intelligent agents for multi-agent, inaccessible, adversarial environments is arguably one of the most challenging areas in artificial intelligence today. Great strides have been made in developing emergent cooperation among teammates, but less progress has been made in quickly and automatically changing overall team strategy in response to adversary actions. One way

that humans do such adaptation is by noting a similarity to a past adversary. This project is a system to do that sort of classification. The system is fully implemented in the simulated robotic soccer environment as used in RoboCup. The system does the following: Each agent observes the adversary and records relevant features. Based on these observations, each agent then classifies the adversary with regards to a set of pre-defined behavioral classes. The agents record their classification, and the team classification is decided by a simple majority. The effectiveness of this system on some simple behavior classes is shown. Future directions can include machine learning of behavior classes and strategy changes for those behavior classes, as well as developing more complicated classes.
DTIC
Machine Learning; Expert Systems

20000027616 Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA
A Case Study on Analytical Analysis of the Inverted Pendulum Real-Time Control System ***Final Report***
Seto, Danbing; Sha, Lui; Nov. 1999; 54p; In English
Contract(s)/Grant(s): F19628-95-C-0003
Report No.(s): AD-A373286; CMU/SEI-99-TR-023; ESC*-TR-99-023; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

An inverted pendulum has been used as the controlled device in a prototype real-time control system employing the Simplex (trademark) architecture. In this report, we address the control issues of such a system in an analytic way. In particular, an analytic model of the system is derived; control algorithms are designed for the baseline control, experimental control and safety control based on the concept of analytic redundancy; the safety region is obtained as the stability region of the system under the safety control; and the control switching logic is established to provide fault tolerant functionality. Finally, the results obtained and the lessons learned are summarized, and future work is discussed.
DTIC
Systems Engineering; Control Systems Design; Fault Tolerance

64
NUMERICAL ANALYSIS

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

20000025451 Louisiana Tech Univ., Center for Numerical Simulation and Modeling, Ruston, LA USA
Implicit and Multigrid Method for Ideal Multigrid Convergence: Direct Numerical Simulation of Separated Flow Around NACA 0012 Airfoil, ***Jan. - Jun. 1999***
Liu, Chao–Qun, Louisiana Tech Univ., USA; Shan, H., Louisiana Tech Univ., USA; Jiang, L., Louisiana Tech Univ., USA; 1999; 25p; In English
Contract(s)/Grant(s): NAG1-2136; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Numerical investigation of flow separation over a NACA 0012 airfoil at large angles of attack has been carried out. The numerical calculation is performed by solving the full Navier-Stokes equations in generalized curvilinear coordinates. The second-order LU-SGS implicit scheme is applied for time integration. This scheme requires no tridiagonal inversion and is capable of being completely vectorized, provided the corresponding Jacobian matrices are properly selected. A fourth-order centered compact scheme is used for spatial derivatives. In order to reduce numerical oscillation, a sixth-order implicit filter is employed. Non-reflecting boundary conditions are imposed at the far-field and outlet boundaries to avoid possible non-physical wave reflection. Complex flow separation and vortex shedding phenomenon have been observed and discussed.
Author
Multigrid Methods; Convergence; Direct Numerical Simulation; Boundary Layer Separation; Computational Fluid Dynamics

65
STATISTICS AND PROBABILITY

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

20000026930 Royal Inst. of Tech., Dept. of Mathematics, Stockholm, Sweden
Existence of Finite Dimensional Realizations for Nonlinear Forward Rate Models
Bjoerk, T.; Svensson, L.; Oct. 1999; 52p; In English

Report No.(s): PB2000-102714; TRITA-MAT-99-MA-19; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

We consider interest rate models of Heath-Jarrow-Marton type, where the forward rates are driven by a multidimensional Wiener process, and where the volatility is allowed to be an arbitrary smooth functional of the present forward rate curve. Using ideas from differential geometry as well as from systems and control theory, we investigate when the forward rate process can be realized by a finite dimensional Markovian state space model, and we give general necessary and sufficient conditions, in terms of the volatility structure, for the existence of a finite dimensional realization. A number of concrete applications are given and most previously known realization results for time homogenous Wiener driven models are included and extended. As a special case we give a general and easily applicable necessary and sufficient condition for when the induced short rate is a Markov process. In particular we show that the only forward rate models, with short rate dependent volatility structures, which generically give rise to a Markovian short rate are the affine ones. These models are thus the only generic short rate models from a forward rate point of view.

NTIS

Economic Analysis; Economy; Nonlinear Systems; Nonlinearity

20000027602 Carnegie-Mellon Univ., Dept. of Computer Science, Pittsburgh, PA USA

Bayesian Network Induction via Local Neighborhoods

Margaritis, Dimitris; Thrun, Sebastian; Aug. 1999; 21p; In English

Report No.(s): AD-A373341; CMU-CS-99-134; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In recent years, Bayesian networks have become highly successful tool for diagnosis, analysis, and decision making in real world domains. We present an efficient algorithm for learning Bayesian networks from data. Our approach constructs Bayesian networks by first identifying each node's Markov blankets, then connecting nodes in a consistent way. In contrast to the majority of work, which typically uses hill climbing approaches that may produce dense nets and incorrect structure, our approach typically yields consistent structure and compact networks by heeding independencies in the data. Compact networks facilitate fast inference and are also easier to understand. We prove that under mild assumptions, our approach requires time polynomial in the size of the data and the number of nodes. A Monte Carlo variant, also presented here, is more robust and yields comparable results at much higher speeds.

DTIC

Neural Nets; Bayes Theorem; Markov Processes

67
THEORETICAL MATHEMATICS

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

20000025548 Naval Postgraduate School, Monterey, CA USA

Summary of Research 1998, Department of Mathematics, *1 Jan. - 31 Dec. 1998*

Owen, Guillermo; Borges, Carlos; Aug. 1999; 34p; In English

Report No.(s): AD-A371855; NPS-09-99-008; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report contains summaries of research projects in the Department of Mathematics. A list of recent publications is also included which consists of conference presentations and publications, books, contributions to books, published journal papers, technical reports, and thesis abstracts.

DTIC

Mathematical Models; Numerical Analysis

20000025745 Hiroshima Univ., Faculty of Science, Japan

Some Homotopy Groups of the Rotation Group Rn

Kachi, Hideyuki, Shinshu Univ., Japan; Mukai, Juno, Shinshu Univ., Japan; 19990701; 20p; In English; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

We determine the group structures of the 2-primary components of the homotopy groups of the rotation group pi (sub k)(R (sub n)) for k = 17 and 18 by use of the fibration R (sub n+1)/R (sub n)= S (exp. n).

Author

Homotopy Theory; Group Theory; Fibers (Mathematics)

20000026836 Brigham Young Univ., Provo, UT USA
Differential Equations and Computational Simulations
Bates, Peter W., Brigham Young Univ., USA; Lu, Kening, Brigham Young Univ., USA; Xu, Daoyi, Brigham Young Univ., USA; Jun. 18, 1999; 506p; In English
Contract(s)/Grant(s): F62562-99-M-9116
Report No.(s): AD-A372508; AOARD-CSP-981019; No Copyright; Avail: CASI; A04, Microfiche; A22, Hardcopy

Topics in these conference proceedings include: (1) Modeling of Micro Diffractive Optics; (2) Symbolic Calculi for Sequences; (3) Global Attractivity of a Delay Difference Model; (4) Dynamics of 2-D Incompressible Flows; (5) The Unique Normal Form Theory; (6) Global Stability of the Second Order Equation; and (7) Robust Stabilization of Integro-Differential Systems.
DTIC
Computerized Simulation; Differential Equations; Neural Nets

20000026839 Cooperative Inst. for Research in the Atmosphere, Fort Collins, CO USA
Bounded Derivative Initialization ***Final Report, 15 Jan. 1998 - 14 Feb. 1999***
Browning, Gerald L., Cooperative Inst. for Research in the Atmosphere, USA; Lu, Chungu, Cooperative Inst. for Research in the Atmosphere, USA; Oct. 22, 1999; 2p; In English
Contract(s)/Grant(s): F49620-98-1-0191
Report No.(s): AD-A372517; AFRL-SR-BL-TR-99-0300; No Copyright; Avail: CASI; A01, Microfiche; A01, Hardcopy

A well-posed, multiscale, fourth-order accurate, limited area model in Cartesian coordinates. with a Kuo cumulus parameterization scheme was developed. The corresponding Bounded Derivative Initialization (BDI) package produced balanced initial fields from Offut AFB AVN vorticity data. The ensuing solution was essentially free of gravity waves.
DTIC
Boundary Layer Flow; Cartesian Coordinates; Gravity Waves; Wavelet Analysis

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.

20000026323 Massachusetts Inst. of Tech., Cambridge, MA USA
Undergraduate Program Flights: Localization of Sound in Micro-Gravity
Krikorian, Raffi, Massachusetts Inst. of Tech., USA; Chakrabarti, Samidh, Massachusetts Inst. of Tech., USA; Singh, Sharmi, Massachusetts Inst. of Tech., USA; Zbarsky, Boris, Massachusetts Inst. of Tech., USA; KC-135 and Other Microgravity Simulations; August 1999, pp. 99-107; In English; See also 20000026303; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

This experiment attempts to find out exactly what effect a micro-gravity environment has on the human body's ability to localize sound in the horizontal and vertical plane as related to the head. Perhaps the most common sensation that astronauts immediately experience in microgravity is severe disorientation. Often this sensory "confusion" leads to space sickness or space adaptation syndrome. Since sound localization is a critical skill that astronauts use to regain their bearings, careful study of sound localization in the micro-gravity environment is required. A better understanding of directional hearing may yield new insights into space sickness and aid in the design of spacecraft, space communication systems, and earth-bound space simulators. Sound localization is a complex computational task that the brain performs with apparent ease. The brain uses a combination of interaural, monaural and dynamic clues to determine the location of a sound.
Derived from text
Disorientation; Hearing; Microgravity; Position (Location); Sound Localization

20000026928 National Defence Research Establishment, Div. of Systems and Underwater Technology, Stockholm, Sweden
Matched Field Processing of Hydroacoustical Data from Kalmarsund
Parastates, E.; Jun. 1999; 26p; In English; Original contains color illustrations
Report No.(s): PB2000-103055; FOA-R-99-01168-409-SE; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Measurements of a moving monochromatic sound source, registered by a vertical hydrophone array, are inverted. A distributed GA (Genetic Algorithm) in combination with range forward modelling, is applied in the search of a parametric

description of the seabottom by means of matched wave fields. The best GA suggestion, is refined by a local optimization and used for replica field generation in matched field source localizations. The localization fails in most of the cases. The poor performance is most likely caused by model mismatch: the actual environment cannot be described sufficiently well with a range independent model.
NTIS
Underwater Acoustics; Acoustic Scattering; Ocean Bottom

20000027442 NASA Ames Research Center, Moffett Field, CA USA
Sonic Boom Prediction Exercise: Experimental Comparisons
Tu, Eugene, NASA Ames Research Center, USA; Cheung, Samson, MCAT Inst., USA; Edwards, Thomas, NASA Ames Research Center, USA; High-Speed Research: 1994 Sonic Boom Workshop. Configuration, Design, Analysis and Testing; December 1999, pp. 13-32; In English; See also 20000027440; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The success of a future High Speed Civil Transport (HSCT) depends on the ability to accurately assess and, possibly, modify the sonic boom signatures of potential designs. In 1992, the Sonic Boom Steering Committee initiated a prediction exercise to assess the current computational capabilities for the accurate and efficient prediction of sonic boom signatures and loudness levels. A progress report of this effort was given at the Sonic Boom Workshop held at NASA Ames Research Center in 1993 where predictions from CFD and Modified Linear Theory (MLT) methods were given. Comparisons between the methods were made at near-, mid- and far-field locations. However, at that time, experimental data from wind-tunnel tests were not available. The current paper presents a comparison of computational results with the now available experimental data. Further comparisons between the computational methods and analyses of the discrepancies in the results are presented.
Author
Sonic Booms; Supersonic Transports; Aerodynamic Noise; Prediction Analysis Techniques

20000027443 NASA Ames Research Center, Moffett Field, CA USA
Design and Computational/Experimental Analysis of Low Sonic Boom Configurations
Cliff, Susan E., NASA Ames Research Center, USA; Baker, Timothy J., Princeton Univ., USA; Hicks, Raymond M., NASA Ames Research Center, USA; High-Speed Research: 1994 Sonic Boom Workshop. Configuration, Design, Analysis and Testing; December 1999, pp. 33-58; In English; See also 20000027440; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Recent studies have shown that inviscid CFD codes combined with a planar extrapolation method give accurate sonic boom pressure signatures at distances greater than one body length from supersonic configurations if either adapted grids swept at the approximate Mach angle or very dense non-adapted grids are used. The validation of CFD for computing sonic boom pressure signatures provided the confidence needed to undertake the design of new supersonic transport configurations with low sonic boom characteristics. An aircraft synthesis code in combination with CFD and an extrapolation method were used to close the design. The principal configuration of this study is designated LBWT (Low Boom Wing Tail) and has a highly swept cranked arrow wing with conventional tails, and was designed to accommodate either 3 or 4 engines. The complete configuration including nacelles and boundary layer diverters was evaluated using the AIRPLANE code. This computer program solves the Euler equations on an unstructured tetrahedral mesh. Computations and wind tunnel data for the LBWT and two other low boom configurations designed at NASA Ames Research Center are presented. The two additional configurations are included to provide a basis for comparing the performance and sonic boom level of the LBWT with contemporary low boom designs and to give a broader experiment/CFD correlation study. The computational pressure signatures for the three configurations are contrasted with on-ground-track near-field experimental data from the NASA Ames 9x7 Foot Supersonic Wind Tunnel. Computed pressure signatures for the LBWT are also compared with experiment at approximately 15 degrees off ground track.
Author
Computational Fluid Dynamics; Sonic Booms; Supersonic Transports; Nacelles; Pressure Distribution; Computational Grids; Wind Tunnel Tests; Inviscid Flow; Computer Programs; Bow Waves

20000027445 Boeing Commercial Airplane Co., Seattle, WA USA
Low Sonic Boom Design Activities at Boeing
Haglund, George T., Boeing Commercial Airplane Co., USA; High-Speed Research: 1994 Sonic Boom Workshop. Configuration, Design, Analysis and Testing; December 1999, pp. 73-87; In English; See also 20000027440
Contract(s)/Grant(s): NAS1-19360; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Low sonic boom studies have continued during the last year with the goal of exploring the ability of practical airplane designs to achieve significantly reduced sonic boom-loudness with reasonable performance penalties. At the 1993 Sonic Boom Workshop, improvements to the low-boom design methods were described and early results of two low-boom configurations -935 and -936)

were presented. Now that the low boom design methods are reasonably mature, recent design activities have broadened somewhat to explore refinements to the -935 and -936 designs. In this paper the results are reported of a detailed systems study and performance sizing of the -935 (Hybrid sonic boom waveform) and the -936 (Flat-top waveform). This analysis included a second design cycle for reduced cruise drag and balance considerations. Another design study was of a small-wing version of the -935. Finally, some preliminary results of the recent LARC UPWT test of the -935 configuration are given, along with a proposed alternative method for extrapolating wind tunnel pressure signatures to the ground. The various configurations studied is also summarized. The topics covered by this paper are as follows: Systems study results of the Baseline -939 and low boom configurations -935 and -936, Small wing derivative of the -935, Wind tunnel test results of the -935, Test-derived F-function and propagation to the ground, and Future considerations (boom-softened baseline, overwater issues, and operations).
Author
Sonic Booms; Aerodynamic Configurations; Aircraft Design; Waveforms; Wings; Aerodynamic Noise

20000027446 MCAT Inst., Moffett Field, CA USA
Sonic Boom Softening of Reference-H
Cheung, Samson, MCAT Inst., USA; High-Speed Research: 1994 Sonic Boom Workshop. Configuration, Design, Analysis and Testing; December 1999, pp. 89-106; In English; See also 20000027440; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

For the past four years, various low-boom configurations have been designed and tested in wind tunnels. However, recent consideration of high speed civil transport (HSCT) flying over water reveals the possibility of a high performance aircraft flying within a specific corridor. Boeing's Reference-H, which is a performance aircraft cruising at Mach 2.4 over-water, is considered as a baseline configuration for the HSCT. Typically, a performance aircraft has higher lift coefficient than a low-boom configuration. It is known to the industry that it is difficult to reduce the sonic boom of a performance aircraft to the noise level of a low-boom aircraft. In the present study, effort was spent to find out what factors make the reduction of loudness level of a performance aircraft so difficult, and to investigate the possibility of reducing the loudness level of Reference-H.
Author
Sonic Booms; Supersonic Transports; Aircraft Design; Aerodynamic Noise; Aircraft Configurations; Noise Intensity; Aerodynamic Coefficients; Aircraft Structures

20000027447 Northrop Grumman Corp., Research and Development Center, Bethpage, NY USA
The Analysis and Design of Low Boom Configurations Using CFD and Numerical Optimization Techniques
Siclari, Michael J., Northrop Grumman Corp., USA; High-Speed Research: 1994 Sonic Boom Workshop. Configuration, Design, Analysis and Testing; December 1999, pp. 107-128; In English; See also 20000027440; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The use of computational fluid dynamics (CFD) for the analysis of sonic booms generated by aircraft has been shown to increase the accuracy and reliability of predictions. CFD takes into account important three-dimensional and nonlinear effects that are generally neglected by modified linear theory (MLT) methods. Up to the present time, CFD methods have been primarily used for analysis or prediction. Some investigators have used CFD to impact the design of low boom configurations using trial and error methods. One investigator developed a hybrid design method using a combination of Modified Linear Theory (e.g. F-functions) and CFD to provide equivalent area due to lift driven by a numerical optimizer to redesign or modify an existing configuration to achieve a shaped sonic boom signature. A three-dimensional design methodology has not yet been developed that completely uses nonlinear methods or CFD. Constrained numerical optimization techniques have existed for some time. Many of these methods use gradients to search for the minimum of a specified objective function subject to a variety of design variable bounds, linear and nonlinear constraints. Gradient based design optimization methods require the determination of the objective function gradients with respect to each of the design variables. These optimization methods are efficient and work well if the gradients can be obtained analytically. If analytical gradients are not available, the objective gradients or derivatives with respect to the design variables must be obtained numerically. to obtain numerical gradients, say, for 10 design variables, might require anywhere from 10 to 20 objective function evaluations. Typically, 5-10 global iterations of the optimizer are required to minimize the objective function. In terms of using CFD as a design optimization tool, the numerical evaluation of gradients can require anywhere from 100 to 200 CFD computations per design for only 10 design variables. If one CFD computation requires an hour of computational time on a Cray computer, one can see that the use of constrained numerical optimization quickly becomes impractical.Hence, in order to practically couple a numerical design optimization technique with a CFD method, the CFD method must be extremely efficient with running times on the order of only minutes. The CFD Euler code developed under NASA sponsorship and referred to as MIM3D-SB for the most part fulfills these efficiency requirements. Analysis of wing- body configurations can be computed in a matter of a few minutes. The present study will concentrate on the feasibility of the use of this CFD code in conjunction with

a numerical design optimization technique for the sonic boom reduction of candidate HSCT configurations. A preliminary supersonic aircraft design system has been established that utilizes the numerical design optimization code NPSOL developed at Stanford University coupled with the supersonic NUM3D-SB CFD code. Many questions still need to be answered in regard to using CFD and numerical optimizers as design tools. There are difficulties related to both the CFD codes and the numerical optimizers. Numerical optimizers can converge to a local minima rather than a global minima. This behavior is largely a function of the initial guess in the design space. The optimizer also is searching for a minimum of the function in terms of its derivative without any regard to the actual function value. Numerically (i.e. CFD) determined gradients can also generate spurious numerical local minima. In addition, for the sonic boom problem, grid fineness will also determine the accuracy of the final design solution. Design optimization methods work well on problems defined by continuous objective functions. The sonic boom signature design problem is not necessarily defined by a continuous objective function. The signature can have a variety of shapes; i.e. from N-wave to multiple shocks. The far-field or ground signature may not transition continuously from one shape to another and hence, may exhibit discontinuous behavior. This is also a source of difficulty in using design optimization methods.In the following sections, several low boom and one reference aircraft configuration will be analyzed to predict their sonic boom signature characteristics. Modifications to some of these designs will also be presented to demonstrate the feasibility of using CFD as a design tool and to demonstrate the feasibility of designing shaped sonic boom signatures. Design modifications to some configurations will be presented to demonstrate the feasibility of achieving shaped signatures with reduced levels and not necessarily to represent realistic or aerodynamically efficient design modifications. Fuselage volume or camber are used as design variables in order to have a minimal effect on the primary wing aerodynamics. The paper will also seek to demonstrate whether a hybrid or ramped signature is feasible to achieve. For the low-boom configurations, the CFD predicted signatures will be compared qualitatively to their MLT design signatures.
Derived from text
Sonic Booms; Supersonic Transports; Aircraft Configurations; Computational Fluid Dynamics; Aircraft Design; Aircraft Structures; Aerodynamic Noise

20000027448 NASA Ames Research Center, Moffett Field, CA USA
Mid-Field Sonic Boom Extrapolation Methodology
Cheung, Samson, NASA Ames Research Center, USA; Davis, Sanford, NASA Ames Research Center, USA; Tu, Eugene, NASA Ames Research Center, USA; High-Speed Research: 1994 Sonic Boom Workshop. Configuration, Design, Analysis and Testing; December 1999, pp. 129-148; In English; See also 20000027440; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

In the design cycle of low-boom airplanes, sonic boom prediction must be accurate and efficient. The classical linear method, Whitham's F-function theory, has been widely applied to predict sonic boom signatures. However, linear theory fails to capture the nonlinear effects created by large civil transport. Computational fluid dynamics (CFD) has been used successfully to predict sonic boom signals at the near and mid fields. Nevertheless, it is computationally expansive in airplane design runs. In the present study, the method of characteristics is used to predict sonic boom signals in an efficient fashion. The governing equations are the axisymmetric Euler's equations with constant enthalpy. Since the method solves Euler's equations, it captures more nonlinear effects than the classical Whitham's F-function technique. Furthermore, the method of characteristics is an efficient marching scheme for initial value problems. In this study, we will first review the current CFD extrapolation technique and the work previously done in sonic boom extrapolation. Then, we will introduce the governing equations and the method of characteristics. Finally, we will show that the present method yields the same accurate results as previous CFD techniques, but with higher efficiency.
Author
Sonic Booms; Aircraft Design; Computational Fluid Dynamics; Method of Characteristics; Euler Equations of Motion; Aircraft Configurations; Aircraft Structures

20000027451 McDonnell-Douglas Aerospace, Long Beach, CA USA
SR-71A Reduced Sonic Boom Modification Design
Morgenstern, John M., McDonnell-Douglas Aerospace, USA; Bruns, David B., McDonnell-Douglas Aerospace, USA; Camacho, Peter P., McDonnell-Douglas Aerospace, USA; High-Speed Research: 1994 Sonic Boom Workshop. Configuration, Design, Analysis and Testing; December 1999, pp. 199-217; In English; See also 20000027440; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The adverse impact of sonic booms stems from the loudness and startle they produce. It is desirable, for future generation supersonic transport studies, to develop technology for reduced sonic boom environmental impact and possibly enhance operational economics. Previous sonic boom reduction studies developed sonic boom waveform shaping as a method for reducing loudness. The shape of the waveform is altered by tailoring the distribution of lift and volume of the vehicle, generating a

waveform shape that does not evolve into an ’N’ wave when it reaches the ground. Waveform shaping has been validated in wind tunnel tests, demonstrating that waveform shaping can be achieved up to several body lengths from a vehicle in a uniform atmosphere. Sonic boom propagation theory has been developed to predict how the sonic boom waveform evolves as it travels to the ground in the real atmosphere, without winds, atmospheric turbulence, or finite rise time calculation. This propagation theory has been validated for’N’ wave sonic booms under calm atmospheric conditions, and predicts the mean loudness well for the more random waveforms obtained under unsteady atmospheric conditions. An investigation was undertaken by McDonnell Douglas, under NASA funding, to determine if a flight experiment could be developed to: demonstrate the propagation of shaped sonic boom waveforms through a real atmosphere, and obtain an indication of the effects of turbulence on sonic boom shaping. This investigation led to the conclusion that an SR-71A was a suitable vehicle for further waveform shaping studies. A very rough analysis developed a preliminary modification, consisting of only volume additions, that appeared to make the experiment feasible. Mom detailed studies were then undertaken to validate methods and refine the design. In-flight data was obtained for the unmodified SR-71A to validate sonic boom predictions in the near-field of the SR-7 I A. An F- I 6XL flew several passes 100 to 500 feet under the SR-7 I A to measure the SR-71A waveform pressure distribution at the design condition of Mach 1.8. McDonnell Douglas Euler CFD calculations linked with propagation codes predicted the pressures under the SR-71A. The CFD propagation method was then used for modification design analysis and the shape of the modification was finalized through an iterative design approach.
Derived from text
Sonic Booms; Supersonic Transports; Waveforms; Noise Reduction; Aircraft Design; Aerodynamic Configurations; Turbulence Effects; Flight Tests; SR-71 Aircraft

20000027452 Lockheed Engineering and Sciences Co., Hampton, VA USA
CFD Predictions of Sonic-Boom Characteristics for Unmodified and Modified SR-71 Configurations
Fouladi, Kamran, Lockheed Engineering and Sciences Co., USA; High-Speed Research: 1994 Sonic Boom Workshop. Configuration, Design, Analysis and Testing; December 1999, pp. 219-235; In English; See also 20000027440
Contract(s)/Grant(s): NAS1-19000; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Shaped sonic-boom signatures refer to signatures that look something other than the typical N-waves. Shaped sonic-boom signatures such as ”flat-top,” ”ramp-type,” or ”hybrid-type” waveforms have been shown to reduce the subjective loudness without requiring reductions in overpressure peaks. The shaping of sonic-boom signatures requires increasing the shock rise time and changes in frequency spectra. So far, a flat-top waveform was shown to be achievable in wind tunnels; however, the influence of long propagation distance and real atmosphere on shaped signatures should be addressed using flight tests. Two different approaches have been proposed for sonic-boom minimization flight tests. The first approach, proposed by Eagle Aerospace, is for a flight test using a modified BQM-34 ”FIREBEE” remotely piloted vehicle. The 30-foot long FIREBEE has a steady state flight condition at the Mach number and altitude of interest, and it can be recovered by helicopter from the water. As an alternative approach, a modified SR-71 vehicle has been proposed by the McDonnell Douglas Corporation. Benefits of the SR-71 include its variable geometry supersonic inlets, small cockpit bulge, higher Mach number capabilities, slender design, and longer length (105 foot). The present investigation addresses the sonic-boom analysis for the second vehicle.The objective of the current investigation is to assess the feasibility of a modified SR-71 configuration, with McDonnell Douglas-designed fuselage modifications, intended to produce shaped sonic-boom signatures on the ground. The present study describes the use of a higher-order computational fluid dynamics (CFD) method to predict the sonic-boom characteristics for both unmodified and modified SR-71 configurations. An Euler unstructured grid methodology is used to predict the near-field, three-dimensional pressure patterns generated by both SR-71 models. The computed near-field pressure signatures are extrapolated to specified distances below the aircraft down to impingement on the ground using the code MDBOOM. Comparisons of the near-field pressure signatures with available flight-test data are presented in the current paper.
Derived from text
Sonic Booms; SR-71 Aircraft; Aircraft Design; Aircraft Structures; Noise Reduction; Computational Fluid Dynamics; Waveforms; Supersonic Inlets; Unstructured Grids (Mathematics)

20000027454 NASA Johnson Space Center, Houston, TX USA
In-Flight Technique for Acquiring Mid- and Far-Field Sonic Boom Signatures
Stansbery, Eugene G., NASA Johnson Space Center, USA; Baize, Daniel G., NASA Langley Research Center, USA; Maglieri, Domenic, J., Eagle Aerospace, Inc., USA; High-Speed Research: 1994 Sonic Boom Workshop. Configuration, Design, Analysis and Testing; December 1999, pp. 249-268; In English; See also 20000027440; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Flight test experiments have been conducted to establish the feasibility of obtaining sonic boom signature measurements below a supersonic aircraft using the NASA Portable Automatic Triggering System (PATS) mounted in the USMC Pioneer Unmanned Aerial Vehicle (UAV). This study forms a part of the NASA sonic boom minimization activities, specifically the demonstration of persistence of modified boom signatures to very large distances in a real atmosphere. The basic objective of the measurement effort was to obtain a qualitative view of the sonic boom signature in terms of its shape, number of shocks, their locations, and their relative strength. Results suggest that the technique may very well provide quantitative information relative to mid-field and far-field boom signatures. The purpose of this presentation is to describe the arrangement and operation of this in-flight system and to present the resulting sonic boom measurements. Adaption and modification of two PATS to the UAV payload section are described and include transducer location, mounting arrangement and recording system isolation. Ground static runup, takeoff and landing, and cruise flight checkouts regarding UAV propeller and flow noise on the PATS automated triggering system and recording mode are discussed. For the proof-of-concept tests, the PATS instrumented UAV was flown under radar control in steady-level flight at the altitude of 8700 feet MSL and at a cruise speed of about 60 knots. The USN F-4N sonic boom generating aircraft was vectored over the UAV on reciprocal headings at altitudes of about 1 1,000 feet MSL and 13,000 feet MSL at about Mach 1. 15. Sonic boom signatures were acquired on both PATS for all six supersonic passes. Although the UAV propeller noise is clearly evident in all the measurements, the F-4 boom signature is clearly distinguishable and is typically N-wave in character with sharply rising shock fronts and with a mid-shock associated with the inlet-wing juncture. Consideration is being given to adapting the PATS/TJAV measurements technique to the NASA Learjet to determine feasibility of acquiring in-flight boom signatures in the altitude range of 10,000 feet to 40,000 feet.
Author
Sonic Booms; Flight Tests; Supersonic Aircraft; In-Flight Monitoring; Far Fields; Shock Fronts; Supersonic Flow

20000027455 NASA Langley Research Center, Hampton, VA USA
Progress in Sonic-Boom Understanding: Lessons Learned and Next Steps
Darden, Christine M., NASA Langley Research Center, USA; High-Speed Research: 1994 Sonic Boom Workshop. Configuration, Design, Analysis and Testing; December 1999, pp. 269-292; In English; See also 20000027440; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

In January 1988, representatives from NASA, NOAA, academia, and industry gathered at the NASA Langley Research Center to assess the status of understanding of the sonic boom which accompanies supersonic flight. As a result of that meeting, a research program on sonic boom within the NASA High-Speed Research (HSR) Program was implemented. This paper discusses the elements of the sonic-boom program, progress which has been made since 1988, and the current change in direction for the Sonic-Boom Element of the NASA HSR Program.
Author
Sonic Booms; Supersonic Transports; Aircraft Design; Aircraft Structures; Noise Reduction

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ATOMIC AND MOLECULAR PHYSICS

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

20000025547 Utah Univ., Dept. of Chemistry, Salt Lake City, UT USA
Interface Formation and Solid-Solid Reactions Induced by Cluster Ion Deposition ***Final Report, 1 Apr. 1996 - 30 Sep. 1999***
Anders, Scott L.; Dec. 16, 1999; 14p; In English
Contract(s)/Grant(s): F49620-96-1-0119
Report No.(s): AD-A371853; AFRL-SR-BL-TR-99-0306; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Development is reported of a unique phase-space-compressing ion deposition beamline, coupled to an ultrahigh vacuum surface preparation/analysis system. The performance of the beamline in low energy focused deposition is discussed. A system of transferrable, high precision sample holders is described. An embedded-atom code developed for simulation of the cluster impact behavior is described. Initial results are presented for deposition, sticking, and penetration of copper atoms and copper dimers impacting on molybdenum and nickel over a wide range of collision energies.
DTIC
Ion Implantation; Reaction Kinetics; Vacuum Deposition; Solid Phases; Solid-Solid Interfaces

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OPTICS

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

20000025303 NASA Marshall Space Flight Center, Huntsville, AL USA
Current Status of Airwatch-OWL Optics
Lamb, David J., NASA Marshall Space Flight Center, USA; [1999]; 14p; In English; Airwatch-OWL Technical Meeting, 13-15 Dec. 1999, Palermo, Italy; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The current status of the OWL (Obstacle Warning Ladar) Optical Design is discussed, and the results of a trade-off study are presented.
Author
Design Analysis; Optical Equipment; Optical Radar; Systems Analysis

20000025491 Vavilov State Optical Inst., Inst. for Laser Physics of SC, Saint Petersburg, USSR
Optically Addressed Spatial Light Modulator Development for Compensated Imaging by Real-Time Holography ***Final Report***
Mak, Arthur A.; Berenberg, Vladimir A.; Jan. 1999; 22p; In English
Contract(s)/Grant(s): F61775-98-W-E098
Report No.(s): AD-A372397; EOARD-SPC-98-4062; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report results from a contract tasking Lasers and Optical Systems as follows: The contractor will investigate and develop improved techniques for producing superior performance optically addressed, spatial light modulators for research use in adaptive optical systems and deliver six such devices for AFRL research use.
DTIC
Light Modulators; Imaging Techniques

75
PLASMA PHYSICS

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

20000025313 Florida Agricultural and Mechanical Univ., Lab. for Modern Fluid Physics, Tallahassee, FL USA
Shock Wave Dynamics in Weakly Ionized Plasmas ***Final Report***
Johnson, Joseph A., III, Florida Agricultural and Mechanical Univ., USA; Jan. 01, 1999; 17p; In English
Contract(s)/Grant(s): NAG1-2114; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An investigation of the dynamics of shock waves in weakly ionized argon plasmas has been performed using a pressure ruptured shock tube. The velocity of the shock is observed to increase when the shock traverses the plasma. The observed increases cannot be accounted for by thermal effects alone. Possible mechanisms that could explain the anomalous behavior include a vibrational/translational relaxation in the nonequilibrium plasma, electron diffusion across the shock front resulting from high electron mobility, and the propagation of ion-acoustic waves generated at the shock front. Using a turbulence model based on reduced kinetic theory, analysis of the observed results suggest a role for turbulence in anomalous shock dynamics in weakly ionized media and plasma-induced hypersonic drag reduction.
Derived from text
Plasma Physics; Shock Waves; Ionized Gases; Argon Plasma; Fluid Dynamics; Plasma Dynamics; Plasma Waves

20000027397 Idaho Univ., Moscow, ID USA
The Application of Thermal Plasmas to Ore Reduction for In Situ Resource Utilization
Prisbrey, Keith A., Idaho Univ., USA; Sayer, Aaron B., Idaho Univ., USA; Wang, Wen–Ming, Idaho Univ., USA; Taylor, Patrick R., Idaho Univ., USA; Space Resources Utilization Roundtable; 1999, pp. 25; In English; See also 20000027384; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Thermal plasma technology has potential utility for metal ore reduction in low gravity, low pressure or vacuum, in situ applications, such as on Mars. Two types of reactors are discussed: Inductively Coupled Plasma and Transferred Arc Plasma. Both are evaluated in terms of thermodynamic potential for reducing oxides such as silica, rutile, hematite, and alumina. Reactor design and fundamental considerations are outlined. Ratios of plasma reactor weight to product output rate are calculated from

experimental laboratory results. The ICP reactor has a significant advantage in terms of low wear and few replacement parts, while the transferred arc system may be useful when electricity is the only source for chemical reducing potential. Proposed flow sheets are given and suggestions for detailed research identified.
Author
Thermal Plasmas; Minerals; Reduction; Thermodynamics

20000027539 State Univ. of New York, Materials Synthesis Lab., Buffalo, NY USA
Growth of Highly Oriented Carbon Nanotubes by Plasma-Enhanced Hot Filament Chemical Vapor Deposition
Huang, Z. P., State Univ. of New York, USA; Xu, J. W., State Univ. of New York, USA; Ren, Z. F., State Univ. of New York, USA; Wang, J. H., State Univ. of New York, USA; Siegal, M. P., Sandia National Labs., USA; Provencio, P. N., Sandia National Labs., USA; Applied Physics Letters; Dec. 28, 1998; ISSN 0003-6951; Volume 73, No. 26, pp. 3845; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Highly oriented, multiwalled carbon nanotubes were grown on polished polycrystalline and single crystal nickel substrates by plasma enhanced hot filament chemical vapor deposition at temperatures below 666 C. The carbon nanotubes range from 10 to 500 nm in diameter and 0.1 to 50 microns in length depending on growth conditions. Acetylene is used as the carbon source for the growth of the carbon nanotubes and ammonia is used for dilution gas and catalysis. The plasma intensity, acetylene to ammonia gas ratio, and their flow rates, etc. affect the diameters and uniformity of the carbon nanotubes.
Author
Vapor Deposition; Crystal Growth; Carbon; Polycrystals; Flow Velocity

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SOLID-STATE PHYSICS

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

20000025343 Florida Univ., Dept. of Materials Science and Engineering, Gainesville, FL USA
Synthesis and Characterization of AlGaTlAs ***Final Report, 15 Jul. 1996-14 Jul. 1999***
Abernathy, C. R.; Sep. 30, 1999; 9p; In English
Contract(s)/Grant(s): F49620-96-1-0344; AF Proj. 3484
Report No.(s): AD-A372218; AFRL-SR-BL-TR-2000-0005; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Initial experiments aimed at determining the utility of adding Al to the growth surface showed no apparent advantage, thus the program was focused on synthesis of compounds containing Ga, Tl and As. Experiments using elemental group III sources and (100) GaAs substrates were performed at various temperatures ranging from 200 deg C - 450 deg C. Attempts to increase the growth temperature while achieving similar Tl-incorporation behavior through the use of GaAs/TlAs and GaAs/TlGaAs superlattices were not successful. Analysis of the non-superlattice samples by electron microprobe (EMPA) showed evidence of Tl incorporation in all films grown at 400 deg C, as shown in Table I.
DTIC
Aluminum Gallium Arsenides; Thallium Alloys; Negative Resistance Devices; Superlattices

20000025346 Army Research Lab., Sensors Directorate, Adelphi, MD USA
Etch Pit Studies of II-VI-Wide Bandgap Semiconductor Materials ZnSe, ZnCdSe, and ZnCdMgSe Grown on InP ***Final Report, Jan. 97***
Semendy, Fred; Bambha, Neal; Tamargo, Marie C.; Cavus, A.; Zeng, L.; Oct. 1999; 19p; In English; Prepared in cooperation with Department of Chemistry, City College, New York, NY. ARL PR: 9NENGG.
Contract(s)/Grant(s): Proj-61102AH47
Report No.(s): AD-A372188; ARL-TR-2013; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Etch pit density (EPD) determination studies have been conducted on II-VI semiconductor materials ZnSe, ZnCdSe, and ZnCdMgSe grown on InP surfaces for the first time by using various etching solutions under different conditions of concentration, temperature, and time. We observed that for the binary, ternary, and quaternary samples, bromine-methanol solution was the only etchant with a reasonable etching effect. We could only perform an in-depth etching study for ZnSe grown on InP by using a

Br:MeOH solution. Other etchants did not have an effect on the surface or morphology of the materials, and hence, a meaningful or consistent EPD could not be determined for ZnCdSe and ZnCdMgSe.
DTIC
Etching; Semiconductors (Materials); Indium Phosphides; Crystal Growth; Zinc Compounds; Zinc Selenides

20000025348 Army Research Lab., Sensors Directorate, Adelphi, MD USA
Growth and Characterization of ZnCdMgSe/ZnCdSe Quantum Wells on InP Substrates for Visible Emitters ***Final Report***
Semendy, Fred; Bambha, Neal; Tamargo, Marie C.; Cavus, A.; Zeng, L.; Oct. 1999; 17p; In English; Prepared in collaboration with Dept. of Chemistry, City College, New York, NY.
Report No.(s): AD-A372186; ARL-TR-2015; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

High-quality lattice-matched quantum well (QW) structures of ZnCdSe/ZnCdMgSe were grown on InP substrates by molecular beam epitaxy. Emission energies from 2.306 to 2.960 eV were measured by low-temperature photoluminescence for samples with QW thicknesses between 5 and 80 A. Bandgap measurements indicate that these structures could be used in entirely lattice-matched blue, green, and yellow diode laser structures. Experimental measurements indicated that these structures have very little strain; hence, these materials could possibly be less prone to degradation than the current II-VI blue-green lasers grown on GaAs substrates.
DTIC
Quantum Wells; Emitters; Molecular Beam Epitaxy; Zinc Selenides; Lasers

20000025444 NASA Marshall Space Flight Center, Huntsville, AL USA
Experiments on Nucleation in Different Flow Regimes
Bayuzick, R. J., Vanderbilt Univ., USA; Hofmeister, W. H., Vanderbilt Univ., USA; Morton, C. M., Vanderbilt Univ., USA; Robinson, M. B., NASA Marshall Space Flight Center, USA; [1998]; 2p; In English; Microgravity Materials Science, 14 Jul. 1998, Huntsville, AL, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The vast majority of metallic engineering materials are solidified from the liquid phase. Understanding the solidification process is essential to control microstructure, which in turn, determines the properties of materials. The genesis of solidification is nucleation, where the first stable solid forms from the liquid phase. Nucleation kinetics determine the degree of undercooling and phase selection. As such, it is important to understand nucleation phenomena in order to control solidification or glass formation in metals and alloys. Early experiments in nucleation kinetics were accomplished by droplet dispersion methods. Dilitometry was used by Turnbull and others, and more recently differential thermal analysis and differential scanning calorimetry have been used for kinetic studies. These techniques have enjoyed success; however, there are difficulties with these experiments. Since materials are dispersed in a medium, the character of the emulsion/metal interface affects the nucleation behavior. Statistics are derived from the large number of particles observed in a single experiment, but dispersions have a finite size distribution which adds to the uncertainty of the kinetic determinations. Even though temperature can be controlled quite well before the onset of nucleation, the release of the latent heat of fusion during nucleation of particles complicates the assumption of isothermality during these experiments. Containerless processing has enabled another approach to the study of nucleation kinetics. With levitation techniques it is possible to undercool one sample to nucleation repeatedly in a controlled manner, such that the statistics of the nucleation process can be derived from multiple experiments on a single sample. The authors have fully developed the analysis of nucleation experiments on single samples following the suggestions of Skripov. The advantage of these experiments is that the samples are directly observable. The nucleation temperature can be measured by noncontact optical pyrometry, the mass of the sample is known, and post-processing analysis can be conducted on the sample. The disadvantages are that temperature measurement must have exceptionally high precision, and it is not possible to isolate specific heterogeneous sites as in droplet dispersions. Levitation processing of refractory materials in ultra high vacuum provides an avenue to conduct these kinetic studies on single samples. Two experimental methods have been identified where ultra high vacuum experiments are possible; electrostatic levitation in ground-based experiments and electromagnetic processing in low earth orbit on TEMPUS. Such experiments, reported here, were conducted on zirconium. Liquid zirconium is an excellent solvent and has a high solubility for contaminants contained in the bulk material as well as those contaminants found in the vacuum environment. Oxides, nitrides, and carbides do not exist in the melt, and do not form on the surface of molten zirconium, for the materials and vacuum levels used in this study. Ground-based experiments with electrostatic levitation have shown that the statistical nucleation kinetic experiments are viable and yield results which are consistent with classical nucleation theory. The advantage of low earth orbit experiments is the ability to vary the flow conditions in the liquid prior to nucleation. The put-pose of nucleation experiments in TEMPUS was to examine.
Author
Experimentation; Solidification; Liquid Phases; Microstructure; Nucleation; Nitrides; Heat of Fusion; Heat Measurement

20000025468 Strathclyde Univ., Glasgow UK

Acoustic, Piezoelectric and Optoacoustic Properties of Organic Materials ***Final Report***

Sherwood, John N.; Sep. 1999; 31p; In English

Contract(s)/Grant(s): N68171-98-M-5166

Report No.(s): AD-A372434; 960513; R/D-8212-CH-01; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Studies have been made of the acoustic, piezoelectric and optoacoustic properties of two acentric organic crystals (-2)-alpha-methyl benzylamino-4-nitropyridine (MBANP) and (-2)-alpha-methyl benzylamino-3 -methyl-4-nitropyridine (3Me-MBANP). These include a) a full study of the linear and non-linear optics of 3Me-MBANP, b) the piezoelectric coefficient d(23) of MBANP, c) the photoelastic coefficients of MBANP In all properties the materials show excellent performance and have promise for use as potential device materials.

DTIC

Piezoelectricity; Acoustic Properties; Organic Materials; Acousto-Optics

20000025502 NASA Lewis Research Center, Cleveland, OH USA

Method for Growth of Crystal Surfaces and Growth of Heteroepitaxial Single Crystal Films Thereon

Powell, J. Anthony, Inventor, NASA Lewis Research Center, USA; Larkin, David J., Inventor, NASA Lewis Research Center, USA; Neudeck, Philip G., Inventor, NASA Lewis Research Center, USA; Matus, Lawrence G., Inventor, NASA Lewis Research Center, USA; Jun. 22, 1999; In English

Patent Info.: Filed 3 Jul. 1997; NASA-Case-LEW-16374-1; US-Patent-5,915-194; US-Patent-Appl-SN-887804; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

A method of growing atomically-flat surfaces and high-quality low-defect crystal film of polytypic compounds heteroepitaxially on polytypic compound substrates that are different than the crystal film. The method is particularly suited for the growth of 3C-SiC. 2H-AlN, and 2H-GaN on 6H-SiC.

Official Gazette of the U.S. Patent and Trademark Office

Crystal Surfaces; Epitaxy; Single Crystals; Substrates; Crystal Growth

20000027496 Illinois Univ. at Urbana-Champaign, Dept. of Chemistry, Urbana, IL USA

Synthesis and Crystal Structure of 5,10,15,20,-Tetrakis(3,5-Dinitrophenyl)Porphyrin

Bhyrappa, P., Illinois Univ. at Urbana-Champaign, USA; Suslick, K. S., Illinois Univ. at Urbana-Champaign, USA; Journal of Porphyrins and Phthalocyanines; 1998; ISSN 1088-4246; Volume 2, pp. 391-396; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The synthesis, characterization and crystal structure of the octanitro-substituted porphyrin 5,10,15,20-tetakis (3,5-dinitrophenyl) porfyrin, H2T(3,5-DNP)P, are described. The solid state structure has two porphyrins in the unit cell with eight pyridine solvates and is made up from columnar arrays of the porphyrins. X-ray crystal structure data: monoclinic, space group Pl2(sub 1)/n1, a = 14.9996(9) A, b = 8.2489(5) A. c = 24.818(2) A, alpha = 90 deg, beta = 104.172(l) deg, gamma = 90 deg, V = 2977.3(3) A(sup 3), d(sub col) = 1.440 g/cu m, Z = 2.

Author

Crystal Structure; Synthesis (Chemistry); Porphyrins

20000027522 Duke Univ., Dept. of Physics, Durham, NC USA

Ordinary and Extraordinary Refractive Indices for A1(sub x)Ga(sub (1-x))N Epitaxial Layers

Bergmann, M. J., Duke Univ., USA; Ozgur, U., Duke Univ., USA; Cassey, H. C., Jr., Duke Univ., USA; Everitt, H. O., Duke Univ., USA; Muth, J. F., Duke Univ., USA; Applied Physics Letters; Jul. 05, 1999; ISSN 0003-6951; Volume 75, No. 1, pp. 65-70; In English

Contract(s)/Grant(s): DAAH04-93-D-0002; N00014-96-I-0738; DAAH04-96-0076; DAAH04-93-D0002

Report No.(s): AD-A369904; ARO-37762.2-PH-SR; Copyright; Avail: Issuing Activity, Microfiche, Hardcopy

Dispersion of the ordinary and extraordinary indices of refraction for wurtzite Al(sub x)Ga(sub (1-x))N epitaxial layers with x=0.00, 0.04, 0.08, 0.11, and 0.20 in the range of wavelengths 457 is less than lambda is less than 980 nm were measured via a prism coupled wavequide technique. The quantitative accuracy of x is +/- 10% and the accuracy of the refractive indices is about +/- 0.01. The dispersion is found to be well described by a 1st-order Sellmeier dispersion formula. A simple functional form is presented that allows calculation of the refractive indices as functions of x and lambda.

Author

Refractivity; Wurtzite; Wave Dispersion

20000027527 NASA Marshall Space Flight Center, Huntsville, AL USA

Polarity Effects of Substrate Surface in Epitaxial ZnO Film Growth

Zhu, Shen, Universities Space Research Association, USA; Su, C.–H., NASA Marshall Space Flight Center, USA; Lehoczky, S. L., NASA Marshall Space Flight Center, USA; Harris, M. T., Air Force Research Lab., USA; Callahan, M. J., Air Force Research Lab., USA; George, M. A., Alabama Univ., USA; McCarty, P., Alabama Univ., USA; [1999]; 1p; In English

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

Epitaxial ZnO films were grown on the two polar surfaces (0-face and Zn-face) of (0001) ZnO single crystal substrates using off-axis magnetron sputtering deposition. As a comparison, films are also deposited on the (000 I) Al203 substrates. It is found that the two polar surfaces have different photoluminescence (PL) spectrum, surface structure and morphology, which are strongly inference the epitaxial film growth. The morphology and structure of epitaxial films on the ZnO substrates are different from the film on the Al203 substrates. An interesting result shows that high temperature annealing of ZnO single crystals will improve the surface structure on the O-face surface rather than the opposite Surface. The measurements of PL, low-angle incident x-ray diffraction, and atomic force microscopy of ZnO films indicate that the O-terminated surface is better for ZnO epitaxial film growth using reactive sputtering deposition.

Author

Epitaxy; Polarity; Single Crystals; Substrates; Zinc Oxides; Film Thickness; Metal Coatings

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PHYSICS OF ELEMENTARY PARTICLES AND FIELDS

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

20000025584 Nippon Telegraph and Telephone Public Corp., Tokyo, Japan

NTT Review, Volume 12

January 2000; 60p; In English; See also 20000025585 through 20000025590; Copyright; Avail: Issuing Activity

This journal presents the NTT (Nippon Telegraph and Telephone) review. The topics include: 1) Quantum Physics for Future Communication Technologies; 2) Single-electron Device; 3) From Quantum Effects to Quantum Circuits; 4) Quantum Information Processing; 5) A New Optical Access System for Wide Area LAN and High-speed Internet Access; and 6) Trends in Software Engineering Standardization.

CASI

Telegraph Systems; Telephones; Communication Equipment; Quantum Mechanics; Information Systems; Computer Programs

20000025587 Nippon Telegraph and Telephone Public Corp., Basic Research Labs., Tokyo, Japan

Quantum Physics for Future Communication Technologies: Towards Quantum Information Processing

Ishihara, Sunao, Nippon Telegraph and Telephone Public Corp., Japan; NTT Review; January 2000; Volume 12, No. 1, pp. 8-11; In English; See also 20000025584; Copyright; Avail: Issuing Activity

NTT (Nippon Telegraph and Telephone) Basic Research Laboratories are devoted to discovering new principles and creating new devices that will have major impacts on 21 st century communications. As examples of such research, in this special issue, we will introduce a single electron device with ultralow power consumption, a quantum computer that will be able to quickly solve problems that are all but unsolvable by present computers, and quantum cryptography that guarantees tamper-free communications.

Author

Quantum Mechanics; Computers; Cryptography; Semiconductor Devices; Data Processing

20000027532 Arizona State Univ., Dept. of Electrical Engineering, Tempe, AZ USA

Issues in General Quantum Transport with Complex Potentials

Ferry, D. K., Arizona State Univ., USA; Barker, J. R., Glasgow Univ., UK; Applied Physics Letters; Jan. 23, 1999; ISSN 0003-6951; Volume 74, No. 4, pp. 582-585; In English

Contract(s)/Grant(s): N00014-96-I-0110

Report No.(s): AD-A366428; Copyright; Avail: Issuing Activity, Microfiche, Hardcopy

Complex potentials have been used previously to simulate dissipative processes in quantum simulations of transport and scattering. A general formulation is presented which shows how such non-Hermitian terms can lead to changes in the dynamics of transport operators, and to the decay of hydrodynamic quantities such as phase, energy, and momentum.
Author
Simulation; Quantum Mechanics; Semiconductor Devices; Coherent Scattering

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SOCIAL AND INFORMATION SCIENCES (GENERAL)

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

20000025306 Space Science Inst., Boulder, CO USA
Outreach to Space Scientists Interested in K-12 Education ***Final Report, Oct. 1995 - Sep. 1998***
Morrow, Cherilynn A, Space Science Inst., USA; [1998]; 5p; In English
Contract(s)/Grant(s): NAS5-3876; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
This is the final report for work on outreach to space scientists interested in k-12 education. It outlines what was accomplished during the two years of support and one year no-cost extension (October 1995-September 1998).
Derived from text
Education; Aerospace Sciences; Scientists

20000025319 Christopher Newport Univ., Dept. of Physics, Computer Science and Engineering, Newport News, VA USA
Technology Development, Implementation and Assessment: K-16 Pre-Service, In-Service and Distance Learning Initiatives ***Final Report, 18 Sep. 1998 - 31 Jul. 1999***
Williams, William B., Jr., Christopher Newport Univ., USA; [1999]; 3p; In English
Contract(s)/Grant(s): NAG1-2112; CNU-33965; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
The technologies associated with distance learning are evolving rapidly, giving to educators a potential tool for enhancing the educational experiences of large numbers of students simultaneously. This enhancement, in order to be effective, must take into account the various agendas of teachers, administrators, state systems, and of course students. It must also make use of the latest research on effective pedagogy. This combination, effective pedagogy and robust information technology, is a powerful vehicle for communicating, to a large audience of school children the excitement of mathematics and science--an excitement that for the most part is now well-hidden. This project,"Technology Development, Implementation and Assessment," proposed to bring to bear on the education of learners in grades 3 - 8 in science and mathematics both advances in information technology and in effective pedagogy. Specifically, the project developed components NASA CONNECT video series--problem-based learning modules that focus on the scientific method and that incorporate problem-based learning scenarios tied to national mathematics and science standards. These videos serve two purposes; they engage students in the excitement of hands-on learning and they model for the teachers of these students the problem-based learning practices that are proving to be excellent ways to teach science and mathematics to school students. Another component of NASA CONNECT is the accompanying web-site.
Derived from text
Education; Instructors; Technology Assessment; Information Systems; Science; Mathematics

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ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20000025771 New Jersey Inst. of Tech., National Center for Transportation and Industrial Productivity, Newark, NJ USA
Moving Telecommuting Forward: An Examination of Organizational Variables ***Final Report***
Rotter, N. G.; Jul. 1999; 90p; In English
Report No.(s): PB2000-102804; NJ-99-006-NCTIP10; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
This project examined the experiences of managers of telecommuters to ascertain what changes, if any, had occurred in their managerial behaviors over a range of processes. Twelve managers of telecommuters were interviewed in depth by means of a semi-structured question format. The content of the interviews was analyzed using QSR NUD(star)IST, software designed to assist in qualitative data analysis. Results indicated that few changes were obtained since most managers were supervising

telecommuters who used the work arrangement part-time. Major findings include the fact that many companies do not track the number of telecommuters, and even where they do, there is a great deal of information or casual telecommuting.
NTIS
Qualitative Analysis; Data Processing; Telecommunication; Communicating; Information Management; Information Flow

20000026929 Professional Engineering Services Ltd., Wayzata, MN USA
Use of Design/Build and Warranties in Highway Construction: Guidelines for Program Implementation ***Final Report***
Johnson, A. M.; Oct. 1999; 64p; In English
Report No.(s): PB2000-102807; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report presents information about requiring warranties on roadway construction. Nationwide, several states have implemented short-term pavement warranty project, and several models are outlined that have successful warranty programs. Both the Wisconsin and Michigan Departments of Transportation have instituted very successful warranty programs. Lessons learned from their experiences could be used to initiate programs in Minnesota, both at a state and local level. Advantages and disadvantages of requiring warranties on highway construction are presented. Design/build contracts are different from warranties, and information about them are presented a swell. Recommendations are given for steps and considerations in implementing a warranty program for local agencies.
NTIS
Highways; Construction; Transportation Networks; Roads

20000026932 General Accounting Office, General Government Div., Washington, DC USA
Managing for Results: Views on Ensuring the Usefulness of Agency Performance Information to Congress
Jan. 2000; 40p
Report No.(s): PB2000-102327; GAO/GGD-00-35; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report addresses the following questions: (1) Which aspects of congressional information needs were met by the agencys annual performance plan or some other source; (2) Where those needs were not met, what accounts for the discrepancies or gaps in the information provided; (3) What options could the agencies use to practically and efficiently provide the desired performance information.
NTIS
Congressional Reports; Information; Governments; Policies

20000027640 Department of Transportation, Transportation Strategic Planning and Analysis Office, Cambridge, MA USA
Comparison of International Transportation R and D Expenditures and Priorities
Sep. 1999; 42p; In English
Report No.(s): PB2000-102487; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

This report provides a summary of total expenditures on research and development (R&D) in general, and of transportation R&D in particular, by the major performers of transportation R&D within the international community. It also compares these levels to total national wealth and enumerates some of the major transportation-related research projects undertaken by these nations, along with their budgets and time frames. It also discusses several recent national efforts to bolster R&D in 'key' and 'critical' technology fields.
NTIS
Transportation; Priorities

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.

20000025310 Air Force Research Lab., Materials and Manufacturing Directorate, Wright-Patterson AFB, OH USA
The USAF Manufacturing Technology Status Report. Winter 1999 ***Progress Report***
Jan. 1999; 16p; In English
Report No.(s): AD-A372465; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This current issue discusses the following topics: Title III Silicon Carbide Contracts; Materials Design Method; ManTech for Affordable Space Systems; Electronic Parts Obsolescence; and Casting Supplier Initiative.
DTIC
Electronic Equipment; Manufacturing; Aerospace Systems

20000025325 Civil Aeromedical Inst., Oklahoma City, OK USA
Enhancing GPS Receiver Certification by Examining Relevant Pilot-Performance Databases ***Final Report***
Joseph, Kurt M., Civil Aeromedical Inst., USA; Jahns, Dieter W., SynerTech Associates, USA; February 2000; 14p; In English
Report No.(s): DOT/FAA/AM-00/4; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The rapid introduction of Global Positioning System (GPS) receivers for airborne navigation has outpaced the capacity of international aviation authorities to resolve human factors issues that concern safe and efficient use of such devices. Current certification technical standards appear to have had little impact on promoting the design of standardized receiver architectures, interfaces and operating manuals -- despite evidence from a variety of sources that lack of standardization may undermine safety. This paper explores the relationship between existing human factors data relevant to GPS-interface design and incident/accident databases, which are a rich source of information and serve to highlight the safety-critical nature of GPS-receiver interface issues. An approach to expanding the role of human factors assessments in the certification of GPS receivers is briefly summarized.
Author
Global Positioning System; Human Factors Engineering; Receivers; Standardization; Aircraft Instruments; Flight Control; Navigation; Flight Paths

20000025475 Army War Coll., Carlisle Barracks, PA USA
Coalition Warfare: A Selected Bibliography
Shope, Virginia C., Compiler; Dec. 1999; 11p; In English
Report No.(s): AD-A372456; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The U.S. Joint Chief of Staff's conceptual template for future warfighting, Joint Vision 2010, states "Although our Armed Forces will maintain decisive unilateral strength, we expect to work in concert with allied and coalition forces in nearly all of our future operations, and increasingly, our procedures, programs, and planning must recognize this reality." to assist student researchers in a better understanding of Coalition Warfare, a special theme of the U.S. Army War College's Academic Year 2000 curriculum, this bibliography provides references to books, documents, and periodical articles available in our library. Most of the items listed have publication dates of 1990 to the present, however some older titles which appear to be of permanent importance are also listed. For your convenience, we have added our call numbers at the end of each entry. Please keep in mind that call numbers may vary from library to library. This bibliography is also available on the Internet through our Library's home page (http://carlisle-www.army.mil/library/).
DTIC
Bibliographies; Documentation; Information Retrieval; Libraries; Warfare

20000025477 Air Force Research Lab., Materials and Manufacturing Directorate, Wright-Patterson AFB, OH USA
Air Force Manufacturing Technology. Year 2000 Project Book
Jan. 2000; 131p; In English
Report No.(s): AD-A372466; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This paper contains information on the following: Advanced Industrial Practices, Electronics, Manufacturing and Engineering Systems, Metals, Nonmetals, and Materials Process Design.
CASI
Armed Forces (USA); Governments; Manufacturing; Metals; Electronic Equipment

20000026924 NCI Information Systems, Inc., NASA Center for AeroSpace Information, Hanover, MD USA
NASA Thesaurus, Volume 1, Hierarchical Listing with Definitions
January 2000; In English; PDF format
Report No.(s): NASA/SP-2000-7501/VOL1-2; NAS 1.21:7501/VOL1-2; NONP/NASA-CD-2000031248; No Copyright; Avail: CASI; E07, CD-ROM; Includes volumes 1 and 2. For hardcopy version see 19980010926.

The NASA Thesaurus contains the authorized subject terms by which the documents in the NASA STI Databases are indexed and retrieved. The scope of this controlled vocabulary includes not only aerospace engineering, but all supporting areas of engineering and physics, the natural space sciences (astronomy, astrophysics, planetary science), Earth sciences, and to some extent, the biological sciences. Volume 1 - Hierarchical Listing With Definitions contains over 17,900 subject terms, 3,948

definitions, and more than 4,000 USE cross references. The Hierarchical Listing presents full hierarchical structure for each term along with 'related term' lists, and can serve as an orthographic authority. Volume 2 - Rotated Term Display is a ready-reference tool which provides over 21,500 additional 'access points' to the thesaurus terminology. It contains the postable and nonpostable terms found in the Hierarchical Listing arranged in a KWIC (key-word-in-context) index. This CD-ROM version of the NASA Thesaurus is in PDF format and is updated to the current year of purchase.
CASI
Hierarchies; Thesauri; Terminology; Aerospace Sciences; Aeronautics; Astronomy; KWIC Indexes

20000027630 Minnesota Univ., Dept. of Computer Science, Minneapolis, MN USA
Archival of Traffic Data, Phase 2 ***Final Report, 1995 - 1998***
Shekhar, S.; Tan, X.; Dec. 1998; 176p; In English
Report No.(s): PB2000-102809; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

Traffic centers gather information from traffic sensors at regular intervals, but storing the data for future analysis becomes an issue. The report details work to improve the speed and effectiveness of traffic databases. In this project phase, researchers redesigned the data model based on the previous phase's data model and decreased the storage requirements by one-third. Researchers developed a web-based Graphical User Interface (GUI) for users to specify the query of interest; the outcome of the performance tuning gave users reasonable response time. The beneficiaries of this effective database would include the driving public, traffic engineers, and researchers, who are generally not familiar with the query language used in the database management system. This report summarizes the detailed reference, such as benchmark query, sample data, table schema, conversion code, and other information.
NTIS
Data Base Management Systems; Information Systems; Data Storage

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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.

20000025304 NASA Marshall Space Flight Center, Huntsville, AL USA
The Impact of NASA's Technology at the State and Local Government Level
Gambrell, S., NASA Marshall Space Flight Center, USA; Stephenson, A., NASA Marshall Space Flight Center, USA; 1999; 34p; In English, 4 Dec. 1999, Quebec City, Canada; Sponsored by Council of State Governments, Canada; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents a speech on The Impact of NASAS's Technology at the State and Local Government level.
CASI
Space Transportation; Lectures; Governments; NASA Programs

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SPACE AND INFORMATION SCIENCES (GENERAL)

20000026337 NASA Goddard Space Flight Center, Greenbelt, MD USA
EGRET Team Papers to be Published in the Proceedings of the Fifth Compton Symposium
[1999]; 58p; In English; 5th, 15-17 Sep. 1999, Portsmouth, NH, USA; See also 20000026338 through 20000026346; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Papers to be included in this symposium are: Detecting the Attenuation of Blazar Gamma-Ray Emission by Extragalactic Background Light with GLAST; Some Aspects of the Radio Emission of EGRET-Detected Blazars; GeV Outburst in Mrk 501; Spectral Modeling of the EGRET 3EG Gamma Ray Sources Near the Galactic Plane; X-ray and Gamma-ray Observations of the COS-B Field 2CG 075+00; Multiwavelength Studies of the Peculiar Gamma-Ray Source 3EG J1835+5918; EGRET/COMPTER

Observations of an Unusual, Steep-Spectrum Gamma-Ray Source; Preliminary Results from a New Analysis Method for EGRET Data; and A Systematic Search for Short-term Variability of EGRET Sources.
CASI
Gamma Ray Observatory; Gamma Ray Telescopes; Papers; Conferences

20000027384 Lunar and Planetary Inst., Houston, TX USA
Space Resources Utilization Roundtable
1999; 52p; In English, 27-29 Oct. 1999, Golden, CO, USA; Sponsored by Colorado School of Mines, USA; See also 20000027385 through 20000027405
Contract(s)/Grant(s): NASW-4574
Report No.(s): LPI-Contrib-988; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This volume contains abstracts that have been accepted for presentation at the Space Resources Utilization Roundtable, October 27-29, 1999, in Golden, Colorado. The program committee consisted of M. B. Duke (Lunar and Planetary Institute), G. Baughman (Colorado School of Mines), D. Criswell (University of Houston), C. Graham (Canadian Mining Industry Research Organization), H. H. Schmitt (Apollo Astronaut), W. Sharp (Colorado School of Mines), L. Taylor (University of Tennessee), and a space manufacturing representative. Administration and publications support for this meeting were provided by the staff of the Publications and Program Services Department at the Lunar and Planetary Institute.
Derived from text
Space Manufacturing; Extraterrestrial Resources; Lunar Exploration

20000027406 Lunar and Planetary Inst., Houston, TX USA
Mars Field Geology, Biology. and Paleontology Workshop: Summary and Recommendations
Budden, Nancy Ann, Editor, Lunar and Planetary Inst., USA; Mars Field Geology,Biology.and Paleontology Workshop: Summary and Recommendations; [1998], pp. 1-80; In English, 18-19 Nov. 1998, Houston, TX, USA; Sponsored by Lunar and Planetary Inst., USA; See also 20000027407 through 20000027413
Contract(s)/Grant(s): NASw-4574
Report No.(s): LPI-Contrib-968; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Current NASA planning envisions human missions to Mars as early as 2013, on a mission that would send six crew members for a 500-day stay on the surface of Mars. While our understanding of how we would get there and back is fairly mature, the planning for what the crew would do to explore while on the surface for 500 days is less detailed. Mission objectives are to understand the composition and geo- morphology of the martian surface, and to continue to investigate and sample the geologic history of Mars. Special emphasis will focus on exploring for possible biogenic signatures, past or present, and on analyzing pre-biotic chemistry. The purpose of this workshop was to explore the strategies, desired capabilities, skills, and operational realities required to lend success to the first human missions to Mars. Current mission planning dictates that there will be considerable mobility, sampling and analytical capability available to human crews, at a site warranting long-term geologic and possibly biological interest. However, the details of specific capabilities are not yet clearly defined.
Derived from text
Mars Surface; Mission Planning; NASA Programs; Manned Mars Missions; Mars (Planet); Conferences

20000027567 NASA Marshall Space Flight Center, Huntsville, AL USA
Fourth USA Microgravity Payload: One Year Report
Ethridge, E. C., Compiler, NASA Marshall Space Flight Center, USA; Curreri, P. A., Compiler, NASA Marshall Space Flight Center, USA; McCauley, D. E., Compiler, Alabama Univ., USA; September 1999; 1p; In English; 4th; Microgravity Payload, 1 Jan. 2000, Huntsville, AL, USA
Report No.(s): NASA/CP-1999-209628; M-939; NAS 1.55:209628; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

This document reports the one year science results for the Fourth United States Microgravity Payload (USMP-4). The USMP-4 major experiments were on a support structure in the Space Shuttle's payload bay and operated almost completely by the Principal Investigators through telescience. The mission included a Glovebox where the crew performed additional experiments for the investigators. Together about eight major scientific experiments were performed, advancing the state of knowledge in fields such as low temperature physics, solidification, and combustion. The results demonstrate the range of quality

science that can be conducted utilizing orbital laboratories in microgravity and provide a look forward to a highly productive Space Station era.
Author
Combustion; Low Temperature Physics; Microgravity; Payloads; Space Processing

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ASTRONOMY

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

20000025315 Hawaii Univ., Inst. for Astronomy, Honolulu, HI USA
Adaptive Optics Imaging of Solar System Objects ***Final Report, 1 Jan. 1997 - 31 Dec. 1999***
Roddier, Francois, Hawaii Univ., USA; Owen, Toby, Hawaii Univ., USA; 1999; 4p; In English
Contract(s)/Grant(s): NAG5-3731; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Most solar system objects have never been observed at wavelengths longer than the R band with an angular resolution better than 1". The Hubble Space Telescope itself has only recently been equipped to observe in the infrared. However, because of its small diameter, the angular resolution is lower than that one can now achieved from the ground with adaptive optics, and time allocated to planetary science is limited. We have successfully used adaptive optics on a 4-m class telescope to obtain 0.1" resolution images of solar system objects in the far red and near infrared (0.7-2.5 microns), aE wavelengths which best discl"lmlnate their spectral signatures. Our efforts have been put into areas of research for which high angular resolution is essential.
Author
Imaging Techniques; Adaptive Optics; Solar System; Infrared Radiation; Images

20000025316 NASA Goddard Space Flight Center, Greenbelt, MD USA
Hubble Space Telescope Servicing Mission 3A
November 1999; 2p; In English
Report No.(s): FS-199-10-033-GSFC; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The Hubble Space Telescope's purpose is to spend 20 years probing the farthest and faintest reaches of the cosmos. Crucial to fulfilling this objective is a series of on-orbit servicing missions. Hubble was placed in orbit on April 25, 1990, by the shuttle Discovery and subsequent servicing followed in December 1993 and February 1997. The third in the series of planned servicing missions for the Hubble Space Telescope was scheduled for June 2000. This third Servicing Mission has been separated into two flights. The first of these flights, Servicing Mission 3A, is scheduled for December 1999, and the second, Servicing Mission 3B, is scheduled for 2001. The fourth Servicing Mission is scheduled for 2003 with a "close-out" Mission in 2010. Three instruments are currently in active scientific use on Hubble - the Wide Field and Planetary Camera 2, the Space Telescope Imaging Spectrograph, and Fine Guidance Sensor I R, which has been designated as the prime FGS for astrometric science. Other instrument bays are occupied by the Near Infrared Camera and Multi-Object Spectrometer (NICMOS), which is now dormant due to the depletion of its solid nitrogen cryogen, the Faint Object Camera, which has been decommissioned, and the corrective optical device called COSTAR, which is no longer needed.
Author
Hubble Space Telescope; Imaging Techniques; Discovery (Orbiter); Space Missions; Spectrometers

20000025442 Smithsonian Astrophysical Observatory, Cambridge, MA USA
Photospheric Fluorescence and Resonance Scattering: Non Classical Diagnostics and the Future of X-ray Stellar Spectroscopy
Drake, Jeremy, Smithsonian Astrophysical Observatory, USA; [1998]; 1p; In English; MPE, 15 un. - 9 Jul. 1998, Munich, Utrecht, Germany, Netherlands
Contract(s)/Grant(s): NAS8-39073; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

High resolution AXAF and XMM observations of stellar coronae will yield a wealth of X-ray plasma line diagnostics that will provide a giant leap forward in our understanding of coronal densities, abundance anomalies and emission measure distributions. Unfortunately, there is one very basic unanswered question in the physics of active stellar coronae that the usual plasma diagnostics cannot address directly: What are the spatial characteristics of stellar coronae-the scale height and filling

factor? What do other stellar coronae actually look like? I will discuss two novel diagnostics of coronal geometry and their application to future X-ray spectra: photospheric fluorescence and resonance line optical depths.
Author
Observation; Stellar Coronas; Plasma Diagnostics; X Ray Fluorescence

20000025498 National Optical Astronomy Observatories, Tucson, AZ USA
The Ionization Source in the Nucleus of M84
Bower, G. A., Kitt Peak National Observatory, USA; Green, R. F., Kitt Peak National Observatory, USA; Quillen, A. C., Arizona Univ., USA; Danks, A., Raytheon STX Corp., USA; Malumuth, E. M., Raytheon STX Corp., USA; Gull, T., NASA Goddard Space Flight Center, USA; Woodgate, B., NASA Goddard Space Flight Center, USA; Hutchings, J., Dominion Astrophysical Observatory, Canada; Joseph, C., Rutgers Univ., USA; Kaiser, M. E., Johns Hopkins Univ., USA; January 2000; 34p; In English
Contract(s)/Grant(s): NAS5-26555; GO-07868.01-96A
Report No.(s): NOAO-Preprint-861; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We have obtained new Hubble Space Telescope (HST) observations of M84, a nearby massive elliptical galaxy whose nucleus contains a approximately 1.5 X 10(exp 9) solar mass dark compact object, which presumably is a supermassive black hole. Our Space Telescope Imaging Spectrograph (STIS) spectrum provides the first clear detection of emission lines in the blue (e.g., [0 II] lambda 3727, HBeta and [0 III] lambda lambda4959,5007), which arise from a compact region approximately 0".28 across centered on the nucleus. Our Near Infrared Camera and MultiObject Spectrometer (NICMOS) images exhibit the best view through the prominent dust lanes evident at optical wavelengths and provide a more accurate correction for the internal extinction. The relative fluxes of the emission lines we have detected in the blue together with those detected in the wavelength range 6295 - 6867 A by Bower et al. indicate that the gas at the nucleus is photoionized by a nonstellar process, instead of hot stars. Stellar absorption features from cool stars at the nucleus are very weak. We update the spectral energy distribution of the nuclear point source and find that although it is roughly flat in most bands, the optical to UV continuum is very red, similar to the spectral energy distribution of BL Lac. Thus, the nuclear point source seen in high-resolution optical images is not a star cluster but is instead a nonstellar source. Assuming isotropic emission from this source, we estimate that the ratio of bolometric luminosity to Eddington luminosity is about 5 x 10(exp -7). However, this could be underestimated if this source is a misaligned BL Lac object, which is a possibility suggested by the spectral energy distribution and the evidence of optical variability we describe.
Author
Black Holes (Astronomy); Elliptical Galaxies; BL Lacertae Objects; Infrared Astronomy; Active Galaxies; Active Galactic Nuclei

20000025757 Computer Sciences Corp., Lanham, MD USA
A Complete UV Atlas of Standard Stars
Wu, Chi–Chao, Computer Sciences Corp., USA; [2000]; 88p; In English; Original contains color illustrations
Contract(s)/Grant(s): NASA Order S-57791-Z; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The general objective of this project is to provide a comprehensive ultraviolet spectral atlas of stars based on the data in the IUE Final Archive. The data have been uniformly processed by the IUE NEWSIPS pipeline system. The NEWSIPS gives an improved signal to noise ratio for the data that will be especially beneficial to low signal portions of the spectra; and it also gives more accurate fluxes for stars by adopting the latest absolute calibration and measured instrument parameters. Our new atlas, therefore, provides more uniform and accurate data than the version previously published. In addition, considerable efforts were devoted to obtain reliable spectral types, V,B-V, and E(B-V). Our goal is to provide the information which can be used with reasonable confidence by scientists.
Derived from text
Ultraviolet Spectra; IUE; Stellar Spectra; Data Processing

20000026856 NASA Goddard Space Flight Center, Greenbelt, MD USA
Ultraviolet, Optical and X-Ray Imaging of Selected Cygnus Loop Fields
Danforth, C. W., Johns Hopkins Univ., USA; Cornett, R. H., Raytheon Co., USA; Blair, W. P., Johns Hopkins Univ., USA; Stecher, T. P., NASA Goddard Space Flight Center, USA; Levenson, N. A.; [1999]; 1p; In English; 195th; Session 43: SN 1987A and Other Supernova Remnants Display, 13 Jan. 2000, Atlanta, GA, USA; Sponsored by American Astronautical Society, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

During the Astro-1 and Astro-2 Space Shuttle missions in 1990 and 1995, far ultraviolet (FUV) images of five 40 ft diameter fields around the rim of the Cygnus Loop Super Nova Remnants (SNR) were observed with the Ultraviolet Imaging Telescope (UIT). These fields sample a broad range of SNR conditions including both radiative and non-radiative shocks in various geometries and scales. The UIT B5 band images discussed here sample predominantly ion-C4 lambda 1550 and the 2-photon

continuum. Smaller contributions are made by emission lines of ion He-2 lambda 1640 and ion 03 lambda 1666. A unique aspect of the B5 band is its ability to sample the hydrogen 2-photon continuum from regions where the gas is recombining. We present these new FUV images and compare them with optical H-alpha and [ion O13], and ROSAT HRI X-ray images. In non-radiative shocks, existing 2-photon flux measurements from spectra and the H-alpha images suggest we are seeing approximately equal contributions from 2-photon and ion C4 emission. In radiative filaments, however, shock models and our images suggest ion C4 should dominate while spectra of specific locations seem to indicate that 2-photon emission dominates. We surmise that spectral observations on specific bright filaments have decreased locally-observed levels of ion C41 emission due to resonance scattering in that line.
Author
Supernova Remnants; Cygnus Constellation; Ultraviolet Astronomy; X Ray Astronomy; Emission Spectra

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ASTROPHYSICS

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

20000025435 Space Telescope Science Inst., Baltimore, MD USA
The Second Most Distant Cluster of Galaxies in the Extended Medium Sensitivity Survey
Donahue, Megan, Space Telescope Science Inst., USA; Voit, G. Mark, Space Telescope Science Inst., USA; Scharf, Caleb A., Space Telescope Science Inst., USA; Gioia, Isabella M., Hawaii Univ., USA; Mullis, Christopher R., Hawaii Univ., USA; Hughes, John P., Rutgers Univ., USA; Stocke, John T., Colorado Univ., USA; The Astrophysical Journal; Dec. 20, 1999; Volume 527, pp. 525-534; In English
Contract(s)/Grant(s): NAG5-3257; NAG5-3208; NAG5-6236; NAG5-3432; GO-05987.02-94A; NSF AST-95-00515; Copyright; Avail: Issuing Activity

We report on our ASCA, Keck, and ROSAT observations of MS 1137.5+6625, the second most distant cluster of galaxies in the Einstein Extended Medium Sensitivity Survey (EMSS), at redshift 0.78. We now have a full set of X-ray temperatures, optical velocity dispersions, and X-ray images for a complete, high-redshift sample of clusters of galaxies drawn from the EMSS. Our ASCA observations of MS 1137.5 +6625 yield a temperature of 5.7 (+2.1)(-1.1) keV and a metallicity of 0.43 (+40)(-3.7) solar, with 90% confidence limits. Keck II spectroscopy of 22 cluster members reveals a velocity dispersion of 884 (+185)(-124) km 24/s. This cluster is the most distant in the sample with a detected iron line. We also derive a mean abundance at z = 0.8 by simultaneously fitting X-ray data for the two z = 0.8 clusters, and obtain an abundance of Z(sub Fe) = 0.33 (+.26)(-.23). Our ROSAT observations show that MS 1137.5+6625 is regular and highly centrally concentrated. Fitting of a Beta model to the X-ray surface brightness yields a core radius of only 71/h kpc (q(sub o) = 0.1) with Beta = 0.70(+.45)(-.15) The gas mass interior to 0.5/h Mpc is thus 1.2 (+0.2)(-0.3) X 10(exp 13) h(exp - 5/2) Solar Mass (q(sub o) = 0.1). If the cluster's gas is nearly isothermal and in hydrostatic equilibrium with the cluster potential, the total mass of the cluster within this same region is 2.1(+1.5)(-0.8) X 10exp 14)/h Solar Mass, giving a gas fraction of 0.06 +/-0.04 h (exp -3/2). This cluster is the highest redshift EMSS cluster showing evidence for a possible cooling flow (about 20-400 Solar Mass/yr). The velocity dispersion, temperature, gas fraction, and iron abundance of MS 1137.5+6625 are all statistically the same as those properties in lower red- shift clusters of similar luminosity. With this cluster's temperature now in hand, we derive a high-redshift temperature function for EMSS clusters at 0.5 is less than z is less than 0.9 and compare it with temperature functions at lower redshifts, showing that the evolution of the temperature function is relatively modest. Supplementing our high-redshift sample with other data from the literature, we demonstrate that neither the cluster luminosity-temperature relation, nor cluster metallicities, nor the cluster gas evolved with redshift. The very modest degree of evolution in the luminosity-temperature relation inferred from these data is inconsistent with the absence of evolution in the X-ray luminosity functions derived from ROSAT cluster surveys if a critical density structure formation model is assumed.
Author
Dark Matter; Galactic Clusters; Luminosity; Metallicity; X Ray Astronomy; Cosmology; Galaxies; Intergalactic Media

20000026854 NASA Goddard Space Flight Center, Greenbelt, MD USA
Cosmic Journeys. to the Edge of Gravity, Space and Time: Structure and Evolution of the Universe Roadmap: 2003-2023
September 1999; 74p; In English; Original contains color illustrations
Report No.(s): NASA/NP-1999-11-184-GSFC; NAS 1.83:11-184-GSFC; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The Roadmap for the Structure and Evolution of the Universe (SEU) Theme embraces three fundamental, scientific quests: (1) to explain structure in the Universe and forecast our cosmic destiny, (2) to explore the cycles of matter and energy in the evolving Universe, (3) to examine the ultimate limits of gravity and energy in the Universe. We develop these quests into six focused research campaigns: (1) Identify dark matter and learn how it shapes galaxies and systems of galaxies, (2) Explore where and when the chemical elements were made (3) Understand the cycles in which matter, energy, and magnetic field are exchanged between stars and the gas between stars, (4) Discover how gas flows in disks and how cosmic jets are formed, (5) Identify the sources of gamma-ray bursts and high-energy cosmic rays, (6) Measure how strong gravity operates near black holes and how it affects the early Universe. These campaigns lead to a portfolio of future major missions of great scientific interest and popular appeal, strongly endorsed by the scientific community. Many have undergone significant initial study. Some are in a state of readiness that make them ideal candidates for the present Office of Space Science Strategic Plan; others may well feature in the next Plan. Each provides a golden scientific opportunity to advance our understanding of the Universe. We have identified three top-priority near-term science objectives together with missions to accomplish these goals. The three problems span a diverse range of subdisciplines, of observational technique, of timescales, and of cost, and are thus complementary, forming a coherent core program for the SEU theme in the 2003-2007 timeframe.These are : (1) Obtain precise measures of the chemical composition and physical conditions in objects ranging from the closest stars to the most distant quasars, (2) Utilize gravitational radiation as a probe of supermassive blackholes throughout the universe, (3) determine the nature of the highest energy cosmic rays. We also describe a small number of exciting missions which are strong candidates for new start status in the midterm, 2008-2013, pending technology development. These missions tackle fundamental problems through the entire electromagnetic spectrum, from the radio through gamma rays, and in many cases develop fascinating technologies with applicability not only elsewhere in NASA but outside of space science as well. Finally, we describe a set of ”vision missions,” which stretch our scientific imagination and set technology challenges for our field.
Author
Universe; Big Bang Cosmology; Cosmochemistry; Galactic Evolution; Astrophysics; Black Holes (Astronomy)

20000027388 Michigan Technological Univ., Houghton, MI USA
Successfully Mining Asteroids and Comets
Gertsch, Leslie, Michigan Technological Univ., USA; Space Resources Utilization Roundtable; 1999, pp. 7; In English; See also 20000027384; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Many ”minor” solar-system bodies contain substantial resources that are necessary for developing and maintaining robust human activity in space. Whether asteroids and comets in near-Earth space contain mineable reserves instead of just mineral resources depends on two factors -- economics and technology -- that will determine the success or failure of long-term space activity, Just as they determine the success or failure of industries on Earth.
Author
Asteroids; Comets; Mining; Solar System

20000027392 Lunar and Planetary Inst., Houston, TX USA
Spacewatch Discovery and Study of Accessible Asteroids
McMillan, Robert S., Lunar and Planetary Inst., USA; Space Resources Utilization Roundtable; 1999, pp. 15-16; In English; See also 20000027384; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Spacewatch is an exploration for asteroids and comets throughout the solar system, from the space near Earth to beyond the orbit of Neptune. Among other things, Spacewatch has reported positions of about 200 000 asteroids, mostly in the main belt, discovered seven objects beyond the orbit of Neptune, eight Centaurs between the orbits of Jupiter and Neptune, and (most relevant to this Roundtable) about 200 Earth-approaching, objects since large-scale Spacewatch surveying was begun a decade ago. In addition to discovering new objects, Spacewatch determines the statistical properties of the various populations of asteroids and comets according to their orbital characteristics and absolute magnitudes. Here we use the term ”Earth Approacher” (EA) to include both asteroids and comet nuclei whose orbits bring them close to the Earth at times, whether or not their orbits cross the Earth’s. ”Close” is defined to be within 0.3 AU, or 5x 10 (exp 7) km. This term is more precise than ”Near Earth Object” (NEO) or ”Near Earth Asteroid” (NEA) because most of the time these objects are not ”near” Earth, in the sense of a cloud following the Earth. Spacewatch observing methods and equipment have been described. The principal differences between Spacewatch and other surveys for asteroids are its deeper limiting magnitude, greater dynamic range of magnitudes, sensitivity to a wider range of angular speeds, and smaller area coverage. Approximately 2000 square degrees are surveyed per year with the 0.9-m telescope of the Steward Observatory on Kitt Peak in southern Arizona. On slow moving objects the limiting V

magnitude is 21.5, about 2 mag, fainter than the MIT/Lincoln Labs' LINEAR survey. Point sources with angular rates between 3 arcsec/hr and (for bright objects) one degree/hr have been detected.
Derived from text
Asteroids; Solar System; Space Exploration; Neptune (Planet); Comet Nuclei

20000027395 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Radar Reconnaissance of Near-Earth Asteroids
Ostro, S. J., Jet Propulsion Lab., California Inst. of Tech., USA; Space Resources Utilization Roundtable; 1999, pp. 21; In English; See also 20000027384; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Groundbased radar observations of NEAs can help identify space resources with commercial potential and can dramatically reduce the cost and risk of the initial spacecraft missions to those objects. The near Earth asteroid (NEA) population is thought to contain approx. 1500 objects as large as a kilometer, approx. 300,000 as large as 100 meters, and more than 100,000,000 as large as 10 meters. More than 10% of the NEAs are more accessible in terms of mission delta-V (i.e., fuel required) than the Moon, Mars, or the moons of Mars. Fewer than 1000 NEAs have been found, but the discovery rate is increasing rapidly. Once an asteroid is discovered (necessarily by wide-field optical telescopes), radar can provide otherwise unavailable information about its size, shape, spin state, and surface properties if it approaches within the range of the Goldstone (California) or Arecibo (Puerto Rico) radar telescopes. Asteroids generally appear as unresolved points through groundbased optical telescopes, but radar measurements of the distribution of echo power in time delay (range) and Doppler frequency (radial velocity) can yield images with resolution as fine as a decameter. Image sequences that furnish adequate orientational coverage can be inverted to construct geologically detailed 3-D models, to define the rotation state precisely, and to constrain the object's internal density distribution. Estimates of radar scattering properties characterize the surface's cm-to-m-scale roughness as well as its bulk density, which for asteroids depends primarily on porosity and metal concentration. A useful spin-off of radar detection is orbit refinement that simplifies navigation of flyby and rendezvous spacecraft.
Derived from text
Reconnaissance; Radar Tracking; Asteroids; Radar Measurement

20000027398 Marconi Integrated Systems, Inc., San Diego, CA USA
Prospecting Near-Earth Asteroids from the Ground
Reed, K. L., Marconi Integrated Systems, Inc., USA; Space Resources Utilization Roundtable; 1999, pp. 27-28; In English; See also 20000027384; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Asteroid prospecting solely by spacecraft is problematic due to the high cost of individual missions and the large number of asteroids needing evaluation. A less expensive initial data acquisition may be accomplished for the majority of near Earth asteroids (NEAs) through the coordinated use of ground-based astronomical observing assets to increase the efficiency and data return of observation, An intensive ground-based campaign of asteroid data acquisition using dedicated instruments and platforms could provide comprehensive knowledge about the physical parameters of a large number of NEAs at much less cost than a series of spacecraft missions. In this manner, a large population of NEAs may be assessed and decisions made regarding their farther exploration and prospecting. NEAs are a diverse population of bodies composed of a broad spectrum of materials. Little is known about any individual NEA, but quite a bit may be generalized from the few observations that have been made. It is now quite certain that some NEAs are volatile-rich (e.,g., H2O) while others are metal-rich (e.g., Fe, Ni, Pt-group). In order for efficient preliminary planning for using asteroid resources, a reliable assessment must be made of possible resources existing on specific asteroids. This may be accomplished expensively, using a large number of spacecraft sent to an equally large number of asteroids, or cheaply, using ground-based assets to assess the usefulness of individual asteroids for specific resource needs.
Derived from text
Asteroids; Data Acquisition; Space Exploration; Space Surveillance (Ground Based)

20000027503 NASA Goddard Space Flight Center, Greenbelt, MD USA
A New Probe of the Molecular Gas Content in Galaxies: Application to M101
Smith, Denise A., Space Telescope Science Inst., USA; Allen, Ronald J., Space Telescope Science Inst., USA; Bohlin, Ralph C., Space Telescope Science Inst., USA; Nicholson, Natalya, McGill Univ., Canada; Stecher, Theodore P., NASA Goddard Space Flight Center, USA; [1999]; 1p; In English; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Recent studies of nearby spiral galaxies suggest that photodissoiation regions (PDRS) are capable of producing much of the observed HI in galaxy disks. In that case, measurements of the observed HI column density and the far-ultraviolet (FUV) photon flux responsible for the photodissociation process provide a new probe of the volume density of the local underlying molecular hydrogen. We develop the method and apply it to the giant Scd spiral M101. The HI column density and amount of FUV emission

have been measured for a sample of 35 candidate PDRs located throughout the disk of M101 using the Very Large Array and the Ultraviolet Imaging Telescope. We find that, after correction for the known gradient of metallicity in the Interstellar Medium (ISM) of M101 and for the extinction of the ultraviolet emission, molecular gas with a narrow range of density from 30-1000/cubic cm is found near star-forming regions at all radii in the disk of M101 out to a distance of 12 seconds approximately equals 26 kpc, close to the photometric limit of R(sub 25) approximately equals 13.5 seconds. In this picture, the ISM is virtually all molecular in the inner parts of M101. The strong decrease of the HI column density in the inner disk of the galaxy at R(sub G) is less than 10 kpc is a consequence of a strong increase in the dust-to-gas ratio there, resulting in an increase of the H(sub 2) formation rate on grains and a corresponding disappearance of hydrogen in its atomic form.
Author
Interstellar Matter; Spiral Galaxies; H I Regions; Stellar Envelopes; Ultraviolet Astronomy; Star Formation

20000027504 NASA Goddard Space Flight Center, Greenbelt, MD USA
Estimation of Mass-Loss Rates from Emission Line Profiles in the UV Spectra of Cool Stars
Carpenter, K. G., NASA Goddard Space Flight Center, USA; Robinson, R. D., NASA Goddard Space Flight Center, USA; Harper, G. M., Colorado Univ., USA; [1999]; 1p; In English; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The photon-scattering winds of cool, low-gravity stars (K-M giants and supergiants) produce absorption features in the strong chromospheric emission lines. This provides us with an opportunity to assess important parameters of the wind, including flow and turbulent velocities, the optical depth of the wind above the region of photon creation, and the star's mass-loss rate. We have used the Lamers et al. Sobolev with Exact Integration (SEI) radiative transfer code along with simple models of the outer atmospheric structure to compute synthetic line profiles for comparison with the observed line profiles. The SEI code has the advantage of being computationally fast and allows a great number of possible wind models to be examined. We therefore use it here to obtain initial first-order estimates of the wind parameters. More sophisticated, but more time-consuming and resource intensive calculations will be performed at a later date, using the SEI-deduced wind parameters as a starting point. A comparison of the profiles over a range of wind velocity laws, turbulence values, and line opacities allows us to constrain the wind parameters, and to estimate the mass-loss rates. We have applied this analysis technique (using lines of Mg II, 0 I, and Fe II) so far to four stars: the normal K5-giant alpha Tau, the hybrid K-giant gamma Dra, the K5 supergiant lambda Vel, and the M-giant gamma Cru. We present in this paper a description of the technique, including the assumptions which go into its use, an assessment of its robustness, and the results of our analysis.
Author
Cool Stars; Radiative Transfer; Supergiant Stars; Ultraviolet Spectra; Ultraviolet Astronomy; Stellar Winds; Stellar Mass Ejection

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LUNAR AND PLANETARY SCIENCE AND EXPLORATION

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

20000025351 Search for Extraterrestrial Intelligence Inst., Mountain View, CA USA
Studies of Mineralogical and Textural Properties of Martian Soil: An Exobiological Perspective
Marshall, John R., Search for Extraterrestrial Intelligence Inst., USA; Studies of Mineralogical and Textural Properties of Martian Soil: An Exobiological Perspective; September 1999; 80p; In English; See also 20000025352 through 20000025386
Contract(s)/Grant(s): NCC2-926; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Research, technical, programmatic, and mission accomplishments for the contract are presented along with thirty six abstracts that were presented at scientific meetings.
CASI
Exobiology; Mineralogy; Mars (Planet); Mars Surface; Soils

20000025352 Search for Extraterrestrial Intelligence Inst., Mountain View, CA USA
Unique Aeolian Transport Mechanisms on Mars: Respective Roles of Percussive and Repercussive Grain Populations in the Sediment Load
Marshall, John R., Search for Extraterrestrial Intelligence Inst., USA; Studies of Mineralogical and Textural Properties of Martian Soil: An Exobiological Perspective; September 1999, pp. 3; In English, 1997, Salt Lake City, UT, USA; Sponsored by Geological Society of America, USA; See also 20000025351

Contract(s)/Grant(s): NCC2-926; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Experiments show that when sand-size grains impact a sediment surface with energy levels commensurate for Mars, small craters are formed by the ejection of several hundred grains from the bed. The experiments were conducted with a modified crossbow in which a sand-impelling sabot replaced the bolt-firing mechanism. Individual grains of sand could be fired at loose sand targets to observe ballistic effects unhindered by aerodynamic mobilization of the bed. Impact trajectories simulated the saltation process on dune surfaces. Impact craters were not elongated despite glancing (15 deg.) bed impact; the craters were very close to being circular. High-speed photography showed them to grow in both diameter and depth after the impactor had ricochetted from the crater site. The delayed response of the bed was ”explosive” in nature, and created a miniature ejecta curtain spreading upward and outward for many centimeters for impact of 100-300 um-diameter grains into similar material. This behavior is explained by deposition of elastic energy in the bed by the ”percussive” grain. Impact creates a subsurface stress regime or ”quasi-Boussinesq” compression field. Elastic recovery of the bed occurs by dilatancy; shear stresses suddenly convert the grains to open packing and they consequently become forcefully ejected from the site. Random jostling of the grains causes radial homogenization of stress vectors and a resulting circular crater. A stress model based on repercussive bed dilatancy and interparticle adhesive forces (for smaller grains) predicts, to first order, the observed crater volumes for various impact conditions. On earth, only a few grains are mobilized by a percussive saltating grain; some grains are ”knudged” along the ground, and some are partly expelled on short trajectories. These motions constitute reptation transport. On Mars, saltation and reptation become indistinct: secondary or ”repercussive” trajectories have sufficient vertical impulse to create a dense saltation population of many tens or hundreds of grains for each single high-speed saltation percussion of the bed. Impact cascading will lead to near-surface distortion of the boundary layer, and choked flow formed by a dense ”slurry” of sand, with the majority of grains mobilized by repercussive forces rather than by aerodynamic lift. This proceeds until a fully-matured transport layer imposes self-limitations as grain-population density constrains the free-path motion of individial grains.

Author

Sands; Sediment Transport; Wind (Meteorology); Wind Effects; Impact Damage; Mars (Planet); Mars Atmosphere

20000025353 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

In Situ Identification of Mineral Resources with an X-Ray-Optical ”Hands-Lens” Instrument

Marshall, J., Search for Extraterrestrial Intelligence Inst., USA; Koppel, L., Oryx Technology Corp., USA; Bratton, C., Search for Extraterrestrial Intelligence Inst., USA; Metzger, E., San Jose State Univ., USA; Hecht, M., Jet Propulsion Lab., California Inst. of Tech., USA; Studies of Mineralogical and Textural Properties of Martian Soil: An Exobiological Perspective; September 1999, pp. 4; In English; In Situ Research Utilization, Nov. 1997, Houston, TX, USA; Sponsored by Lunar and Planetary Inst., USA; See also 20000025351

Contract(s)/Grant(s): NCC2-926; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The recognition of material resources on a planetary surface requires exploration strategies not dissimilar to those employed by early field geologists who searched for ore deposits primarily from surface clues. In order to determine the location of mineral ores or other materials, it will be necessary to characterize host terranes at regional or subregional scales. This requires geographically broad surveys in which statistically significant numbers of samples are rapidly scanned from a roving platform. to enable broad-scale, yet power-conservative planetary-surface exploration, we are developing an instrument that combines x-ray diffractometry (XRD), x-ray fluorescence spectrometry (XRF), and optical capabilities; the instrument can be deployed at the end of a rover’s robotic arm, without the need for sample capture or preparation. The instrument provides XRD data for identification of mineral species and lithological types; diffractometry of minerals is conducted by ascertaining the characteristic lattice parameters or ”d-spacings” of mineral compounds. D-spacings of 1.4 to 25 angstroms can be determined to include the large molecular structures of hydrated minerals such as clays. The XRF data will identify elements ranging from carbon (Atomic Number = 6) to elements as heavy as barium (Atomic Number = 56). While a sample is being x-rayed, the instrument simultaneously acquires an optical image of the sample surface at magnifications from lx to at least 50x (200x being feasible, depending on the sample surface). We believe that imaging the sample is extremely important as corroborative sample-identification data (the need for this capability having been illustrated by the experience of the Pathfinder rover). Very few geologists would rely on instrument data for sample identification without having seen the sample. Visual inspection provides critical recognition data such as texture, crystallinity, granularity, porosity, vesicularity, color, lustre, opacity, and so forth. These data can immediately distinguish sedimentary from igneous rocks, for example, and can thus eliminate geochemical or mineral ambiguities arising, say between arkose and granite. It would be important to know if the clay being analyzed was part of a uniform varve deposit laid down in a quiescent lake, or the matrix of a megabreccia diamictite deposited as a catastrophic impact ejecta blanket. The unique design of the instrument, which combines Debye-Scherrer geometry with elements of standard goniometry, negates the need for sample preparation of any kind, and thus negates the need for power-hungry and mechanically-complex sampling systems that would have to chip, crush, sieve, and mount the sample for x-ray analysis. Instead, the instrument is simply

rested on the sample surface of interest (like a hand lens); the device can interrogate rough rock surfaces, coarse granular material, or fine rock flour. A breadboard version of the instrument has been deployed from the robotic arm of the Marsokhod rover in field trials at NASA Ames, where large vesicular boulders were x-rayed to demonstrate the functionality of the instrument design, and the ability of such a device to comply with constraints imposed by a roving platform. Currently under development is a flight prototype concept of this instrument that will weigh 0.3 kg, using about 4500 J of energy per sample analysis. It requires about 5 min. for XRD analysis, and about 30 min. for XRF interrogation. Its small mass and rugged design make it ideal for deployment on small rovers of the type currently envisaged for the exploration of Mars (e.g., Sojourner-scale platforms). The design utilizes a monolithic P-N junction photodiode pixel array for XRD, a Si PIN photodiode/avalanche photodiode system for XRF, and an endoscopic imaging camera system unobtrusively embedded between the detectors and the x-ray source (the endoscope with its board-mounted camera can be adapted for IR light in addition to visible wavelenths. A rugged, miniature (7 cu cm) x-ray source for the instrument has already been breadboarded.
Author
Geological Surveys; Mineral Deposits; Mars Surface; Extraterrestrial Resources

20000025354 San Jose State Univ., Dept. of Geology, CA USA
X-Ray Fingerprinting Techniques for Recognizing A Hydrological Role in the Formation of Minerals on the Surface of Mars
Metzger, Ellen P., San Jose State Univ., USA; John, R., Search for Extraterrestrial Intelligence Inst., USA; Studies of Mineralogical and Textural Properties of Martian Soil: An Exobiological Perspective; September 1999, pp. 5; In English, 1997, Salt Lake City, UT, USA; Sponsored by Geological Society of America, USA; See also 20000025351
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Previous work has demonstrated the ability of a miniaturized XRD-XRF instrument to perform in-situ analyses without sample preparation or acquisition. Deployment of this instrument on a Martian rover will allow a large number of rapid qualitative analyses, which will maximize the diversity of samples studied and selected for possible return. As a first step in designing a decision tree for recognizing minerals in complex mixtures, d spacings were plotted against intensity for several mineral groups comprising rock and soil types inferred for the surface of Mars (weathered basalt, playa and hydrothermal deposits, clay-rich soils). In all groups, d spacings cluster in a range from about 1-4 angstroms, which can under certain circumstances obscure patterns for individual phases. However, within the silicate family, minerals containing either bound OH- or molecules of H20 (clays, micas, amphiboles, zeolites) are characterized by a shift of peaks to higher d spacings. Large d spacings (greater than about 7 angstroms) thus act as a first-order filter for distinguishing hydrous from anhydrous silicates. The ability to quickly verify the presence of silicates that have interacted with water has important implications for using mineral chemistry and structure to help decipher the hydrologic and atmospheric history of Mars. This represents a beginning for developing more sophisticated methods of pattern recognition. These will combine XRD and XRF analyses with optical data to rapidly7 discern environmentally diagnostic assemblages without the necessity of identifying every peak individual mineral phase.
Author
Mars (Planet); Mars Surface; Minerals; Pattern Recognition; Soils; Water; Moisture

20000025355 Search for Extraterrestrial Intelligence Inst., Moffett Field, CA USA
Behavior of Windblown Sand on Mars: Results from Single-Particle Experiments
Marshall, J. R., Search for Extraterrestrial Intelligence Inst., USA; Borucki, J., NASA Ames Research Center, USA; Sagan, C., Cornell Univ., USA; Studies of Mineralogical and Textural Properties of Martian Soil: An Exobiological Perspective; September 1999, pp. 6-7; In English; Lunar and Planetary, 1996, Unknown; See also 20000025351
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Experiments are investigating the behavior of individual sand grains in the high-energy martian aeolian regime. Energy partitioning during impact of a saltating grain determines grain longevity, but it also influences the way in which the bed becomes mobilized by reptation. When single grains of sand are fired into loose beds, the bed can absorb up to 90% of the impact energy by momentum transfer to other grains; it has been discovered that the impacting grains cause circular craters even at low impact angles. Hundreds of grains can be splashed by a single high-velocity (100 m/s) impact causing more bed disturbance through reptation than previously thought. The research is supported by NASA's PG&G Program. Because the martian aeolian environment in both high energy and of long duration, the most mobile fractions of windblown sand should have eradicated themselves by attrition, unless sand supply has kept pace with destruction. It is therefore important to understand the rate of grain attrition in order to make sense of the existence of vast dune fields on Mars. Attrition, has been addressed in other studies, but precise data for a single saltating grain striking a loose bed of sand have not been acquired -- the quintessential case to be understood for dunes on Mars. to acquire these data, we are employing a compound crossbow which has the bolt-firing mechanism

replaced with a pneumatically-automated sabot system. The sabot can launch individual grains of sand of any size between several millimeters and about 50 microns, at velocities up to 100m/s. This is around the maximum velocity expected for saltating grains on Mars. The sabot sled is equipped with photoelectric sensors for measuring shot velocity. Baffling of the grain's exit orifice has enabled projection of single grains without significant aerodynamic effects from the sabot. Grains are fired into loose beds of sand at about 15 degrees from the horizontal (typical saltation trajectory at impact) while being filmed on high-speed video. High-intensity pulse illumination for the grains is triggered by the solenoid-operated bow trigger. A 45 degree mirror over the impact site provides simultaneous horizontal and vertical images of the impact on each video frame. UV fluorescence is enabling grain and grain-fragment recovery. At 100 m/s, grains of all sizes shatter into many fragments when the sand is replaced with a solid target. Kinetic energy of the grains at this velocity exceeds the critical energy for catastrophic failure of minerals. Although probably exceptional as a grain speed, it suggests that conditions on Mars might elevate materials into an attrition regime not encountered on other planets; individual grains blown across rock pavements on Mars will have short lifespans. When experimental grains impact loose (dune) sand, much, if not most of the kinetic energy is converted into momentum of other grains. Using high-speed filming, the energy involved in splashing grains at the impact site can be derived from the size of the crater, the speed of the splashed grains, and the rebound speed of the impactor. The amount of energy partitioned into material failure (as opposed to momentum) is too small a fraction of the total to be calculated under these circumstances. This does not necessarily mean that little damage occurs to the grains (the full extent of the damage has yet to be determined) because only a small fraction of the impact energy is required for inducing brittle fracture. Damage is orders of magnitude less than during impact against solid surfaces.
Author
Mars Surface; Sands; Sediment Transport; Wind (Meteorology); Wind Effects; Dust Storms; Mars Atmosphere

20000025356 Search for Extraterrestrial Intelligence Inst., Moffett Field, CA USA
Dust on Mars: An Aeolian Threat to Human Exploration?
Marshall, J., Search for Extraterrestrial Intelligence Inst., USA; Studies of Mineralogical and Textural Properties of Martian Soil: An Exobiological Perspective; September 1999, pp. 8; In English, 1998, San Francisco, CA, USA; Sponsored by American Geophysical Union, USA; See also 20000025351
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The NASA HEDS Program is duly concerned for human explorers regarding the potential hazard posed by the ubiquitous dust mantle on Mars. to evaluate properties of dust that could be hazardous to humans, the MPS 2001 Lander payload will include the Mars Environmental Compatibility Assessment (MECA) experiment. This includes optical and atomic-force microscopy to evaluate soil grains for shape and size, wet chemistry to evaluate toxic substances, electrometry to evaluate triboelectric charging, and test-material palets to evaluate electrostatic and magnetic adhesion, and the hardness/abrasiveness of soil grains; these experimental subcomponents are delivered samples by the camera-equipped robotic arm of the lander which will acquire material from depths of 0.5 to 1.0 m in the soil. Data returned by MECA will be of value to both the BEDS and planetary/astrobiology communities. Dust poses a threat to human exploration because the martian system does not hydrologically or chemically remove fine particles that are being continuously generated by thermal, aeolian, and colluvial weathering, and by volcanism and impact over billions of years. The dust is extremely fine-grained, in copious quantities, ubiquitous in distribution, continually mobile, and a source of poorly-grounded static charges -- a suite of characteristics posing a particulate and electrical threat to explorers and their equipment. Dust is mobilized on global and regional scales, but probably also unpredictably and violently at local scales by dust devils. The latter might be expected in great abundance owing to near surface atmospheric instability (dust devils were detected by Pathfinder during its brief lifetime). Preliminary laboratory experiments suggest that space-suit materials subjected to windblown dust may acquire a uniform, highly adhesive dust layer that is also highly cohesive laterally owing to electrostatic forces. This layer will obscure visibility through the helmet visor, penetrate joints and fabrics, change the thermal properties of the suit, and possibly affect electronic/electrical suit functions. It is paramount that future missions address the issue of interparticle forces, and in particular, the role played by ionizing radiation in affecting these forces on Mars.
Author
Dust; Mars (Planet); Soils; Wind (Meteorology); Wind Effects; Mars Surface; Dust Storms; Mars Environment

20000025357 Washington Univ., Dept. of Earth and Planetary Sciences, Saint Louis, MO USA
Compositional Analysis of Martian Soil: Synergism of APEX and MECA Experiments on MPS 2001
Arvidson, R., Washington Univ., USA; Marshall, J., Search for Extraterrestrial Intelligence Inst., USA; Studies of Mineralogical and Textural Properties of Martian Soil: An Exobiological Perspective; September 1999, pp. 9; In English, 1998, San Francisco, CA, USA; Sponsored by American Geophysical Union, USA; See also 20000025351
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The APEX (ATHENA Precursor Experiment) payload for the Mars 2001 mission will analyze soil and dust with a multispectral panoramic imager and an emission spectrometer on a mast on the lander, a Moessbauer spectrometer on the lander robotic arm (RA), and APXS measurements on the Marie Curie rover. These analytical methods will provide data on elemental abundances and mineralogy. The MECA payload on the lander will apply microscopy, AFM, wet chemistry, adhesive substrates, and electrometry to determine the shape and size of particles in the soil and dust, the presence of toxic substances, and electrostatic, magnetic, and hardness qualities of particles. The two experiments will complement one another through several interactions: (1) The panoramic imager provides the geological setting in which both APEX and MECA samples are acquired, (2) The RA provides samples to MECA from the surface and subsurface and will permit APEX analytical tools access to materials below the inunediate surface, (3) Comparisons can be made between elemental analyses of the Moessbauer, IR, APXS on APEX and the wet chemistry of MECA which will define trace elements (ionic species in solution) and soil redox potential and conductivity. (4) APEX bulk compositional measurements will place MECA trace measurements in context, and similarly, MECA microscopy will provide particle size data that may correlate with compositional differences determined by the APEX instruments. Additionally, lithic fragments viewed by the NMCA microscope station should correlate with mineral/rock species inferred by APEX data, (5) If APEX instruments detect quartz for example, the scratch plates of the N4ECA microscope stage will define if a mineral of this hardness is registered during abrasion tests. This is by no means an exhaustive list of potential interactions, but it is clear that both the sheer number of analytical techniques and their complementarity should provide an analytically powerful capability for both planetary and BEDS communities.
Author
Mars (Planet); Mars Missions; Mineralogy; Payloads; Soils; Chemical Composition; Experiment Design; Mars Surface; Mars Environment

20000025358 Search for Extraterrestrial Intelligence Inst., Moffett Field, CA USA
X-Ray Diffraction Techniques for a Field Instrument: Patterns of Lithologic Provences
Marshall, J., Search for Extraterrestrial Intelligence Inst., USA; Keaten, R., San Jose State Univ., USA; Studies of Mineralogical and Textural Properties of Martian Soil: An Exobiological Perspective; September 1999, pp. 10; In English, 1997, Salt Lake City, UT, USA; Sponsored by Geological Society of America, USA; See also 20000025351
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Future exploration of Mars will attempt to shed light on the mineralogy of surface materials. Instruments deployed from remote platforms should have the capability to conduct both intensive analyses as well as rapid, reconnaissance surveys while they function in the martian environment as surrogate geologists. In order to accommodate the reconnaissance mode of analysis and to compensate for analytical limitations imposed by the space-flight conditions, data analysis methods are being developed that will permit interpretation of data by recognition of signatures or ”fingerprints”. Specifically, we are developing a technique which will allow interpretation of diffraction patterns by recognition of characteristic signatures of different lithologic provences. This technique allows a remote vehicle to function in a rapid-scan mode using the lithologic signature to determine where a more thorough analysis is needed. An x-ray diffraction pattern is characterized by the angular positions of diffracted x-rays, x-ray intensity levels and background radiation levels. These elements may be used to identify a generalized x-ray signature. Lithologic signatures are being developed in two ways. A signature is composed using the ideal powder diffraction indices from the mineral assembledge common to a specific lithologic provence. This is then confirmed using a laboratory diffraction pattern of a whole rock powder. Preliminary results comparing the diffraction signatures of the major mineral assembledges common to basalt, carbonate, and evaporite basin deposits indicate that lithologies are differentiable as a ”fingerprint”. Statistical analyses are being performed to establish the confidence levels of this technique.
Author
Diffraction Patterns; Lithology; Mars Environment; Signatures; X Ray Diffraction; Mars (Planet)

20000025359 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
MECA Electrometer: Initial Experimental Results
Buehler, M., Jet Propulsion Lab., California Inst. of Tech., USA; Cheng, L.–J., Jet Propulsion Lab., California Inst. of Tech., USA; Orient, O., Jet Propulsion Lab., California Inst. of Tech., USA; Gompf, R., NASA Kennedy Space Center, USA; Bayliss, J., NASA Kennedy Space Center, USA; Rauwerdink, J., NASA Kennedy Space Center, USA; Marshall, J., Search for Extraterrestrial Intelligence Inst., USA; Studies of Mineralogical and Textural Properties of Martian Soil: An Exobiological Perspective; September 1999, pp. 13-15; In English; 5th; Fifth International Conference on Mars, 18-23 Jul. 1999, Pasadena, CA, USA; See also 20000025351
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The Mars ’01 lander contains an electrometer designed to evaluate the electrostatic nature of the Martian regolith (soil) and atmosphere. The electrometer is part of MECA (Mars Environmental Compatibility Assessment) project. The objective is to gain a better understanding of the hazards related to the human exploration of Mars The sensor has an electric field sensitivity of 35 kV/cm-V and room temperature drift of about 3 microV/sec. The sensor has been operated as low as -60 C where the drift is undetected.
Author
Electrometers; Mars Surface; Planetary Geology; Soils; Mars Atmosphere; Mars Surveyor 2001 Mission

20000025360 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
The Mars Environmental Compatibility Assessment MECA Abrasion Tool
Kuhlman, K. R., Jet Propulsion Lab., California Inst. of Tech., USA; Anderson, M. S., Jet Propulsion Lab., California Inst. of Tech., USA; Hinde, B. D., Jet Propulsion Lab., California Inst. of Tech., USA; Hecht, M. H., Jet Propulsion Lab., California Inst. of Tech., USA; Pike, W. T., Jet Propulsion Lab., California Inst. of Tech., USA; Marshall, J., NASA Ames Research Center, USA; Meloy, T. P., West Virginia Univ., USA; Cobbly, T., West Virginia Univ., USA; Studies of Mineralogical and Textural Properties of Martian Soil: An Exobiological Perspective; September 1999, pp. 16-17; In English; 5th; Fifth international Conference on Mars, 18-23 Jul. 1999, Pasadena, CA, USA; See also 20000025351
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The Mars Environmental Compatibility Assessment (MECA) experiment, an instrument suite to be flown on Mars Surveyor 2001, will include a tool for doing simple mineralogical scratch and streak tests on particles from the Martian regolith. The Abrasion Tool will be applied to particles that adhere to highly polished substrates of various hardnesses. Granular soil components will be subjected to a compressive force of about 3 N using a leaf spring. The spring will be applied with a paraffin actuator capable of a 0.76 mm throw to achieve a maximum displacement of about 7.5 mm at the tip of the tool. The pressure per grain will be dependent on the grain size, the number of grains that adhere to the substrate and the number of grains in compression. The pressure per particle is expected to be on the order of 100 MPa - 1 GPa. The MECA sample wheel containing the substrates will be rotated after the particles are placed in compression to produce scratches or pits. A primary goal of the Abrasion Tool is to identify quartz (Mohs’ hardness = 7) using substrates of varying hardnesses. Quartz is considered hazardous to future human explorers of Mars because it can cause silicosis of the lungs if it is of respirable size. It is also hazardous to machinery, structures, and space suits because of its ability to abrade and scratch surfaces. Since large quantities of minerals harder than quartz are not expected, any scratches produced on polished quartz substrates might be reasonably attributed to quartz particles, although there may be minerals such as impact metamorphic diamond in the soils. Careful calibration of the tool will be necessary to ensure that grains are not overloaded; for example, a steel ball pressed into glass will produce a Hertzian fracture, even though it is softer than glass. Other minerals, such as magnetite (Mohs’hardness = 6.5) have been shown to scratch glass ceramics such as Zerodur (Mohs’ hardness = 6.5). Thus, minerals can be differentiated: note that regardless of the mineral species, if any particle is harder than 6.5 it will certainly be an interesting discovery for both planetary geology and human exploration concerns. The scratches will be identified using the 6X optical microscope and profiled with the atomic force microscope included in the MECA instrument suite. Analysis of the scratch morphology will yield evidence concerning the shape of the particle responsible for producing each scratch. For example, angular grains should leave vertical cracks with microconchoidal lateral chipping, while rounded grains might leave chattermarks, or nested partial Hertzian cracks. Particle shape can thus be inferred from these indentation modes, as well as material hardness. In addition, particle size information may also be available if pits caused by rolling particles can be identified. Converse to scratching, the minerals may be crushed at their contact points, and be smeared onto the target substrates to leave what geologists refer to as ”streaks”. These are coldwelded trails of mineral material that have structure and color indicative of mineral composition. The AFM will determine the morphology of these streaks, while the microscope will ascertain the color. On the harder substrates, we might expect streaking to dominate; on the softer substrates, scratching may dominate. Progressions of material interactions across the substrate selection will be a valuable source of data for mineral discrimination. It should also be noted that many minerals have coatings (such as iron oxides), and these will have to be differentiated from the host mineral grains; laboratory tests will establish the effects of such coatings on the scratch results. Finally, we note that the microscope will provide corroborative data regarding likely mineral species by grain shapes, fracture patterns, surface textures, colr, and UV fluorescence reactions.
Author
Abrasion; Mars Surface; Mars Surveyor 2001 Mission; Quartz; Mars (Planet); Mars Environment

20000025361 NASA Ames Research Center, Moffett Field, CA USA
Aeolian Sand Transport in the Planetary Context: Respective Roles of Aerodynamic and Bed-Dilatancy Thresholds
Marshall, J. R., Search for Extraterrestrial Intelligence Inst., USA; Borucki, J., NASA Ames Research Center, USA; Bratton, C.,

Search for Extraterrestrial Intelligence Inst., USA; Studies of Mineralogical and Textural Properties of Martian Soil: An Exobiological Perspective; September 1999, pp. 18-20; In English; 29th; Lunar and Planetary Science, 16-20 Mar. 1998, Houston, TX, USA; See also 20000025351
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The traditional view of aeolian sand transport generally estimates flux from the perspective of aerodynamic forces creating the airborne grain population, although it has been recognized that ”reptation” causes a significant part of the total airborne flux; reptation involves both ballistic injection of grains into the air stream by the impact of saltating grains as well as the ”nudging” of surface grains into a creeping motion. Whilst aerodynamic forces may initiate sand motion, it is proposed here that within a fully-matured grain cloud, flux is actually governed by two thresholds: an aerodynamic threshold, and a bed-dilatancy threshold. It is the latter which controls the reptation population, and its significance increases proportionally with transport energy. Because we only have experience with terrestrial sand transport, extrapolations of aeolian theory to Mars and Venus have adjusted only the aerodynamic factor, taking gravitational forces and atmospheric density as the prime variables in the aerodynamic equations, but neglecting reptation. The basis for our perspective on the importance of reptation and bed dilatancy is a set of experiments that were designed to simulate sand transport across the surface of a martian dune. Using a modified sporting crossbow in which a sand-impelling sabot replaced the bolt-firing mechanism, individual grains of sand were fired at loose sand targets with glancing angles typical of saltation impact; grains were projected at about 80 m/s to simulate velocities commensurate with those predicted for extreme martian aeolian conditions. The sabot impelling method permitted study of individual impacts without the masking effect of bed mobilization encountered in wind-tunnel studies. At these martian impact velocities, grains produced small craters formed by the ejection of several hundred grains from the bed. Unexpectedly, the craters were not elongated, despite glancing impact; the craters were very close to circular in planform. High-speed photography showed them to grow in both diameter and depth after the impactor had ricochetted from the crater site. The delayed response of the bed was ”explosive” in nature, and created a miniature ejecta curtain spreading upward and outward for many centimeters for impact of 100-300 micron-diameter grains into similar material. Elastic energy deposited in the bed by the impacting grain creates a subsurface stress regime or ”quasi-Boussinesq” compression field. Elastic recovery of the bed occurs by dilatancy; shear stresses suddenly convert the grains from closed to open packing, and grains are consequently able to eject themselves forcefully from the impact site. Random jostling of the grains causes radial homogenization of stress vectors and a resulting circular crater. There is a great temptation to draw parallels with cratering produced by meteorite impacts, but a rigorous search for common modelling ground between the two phenomena has not been conducted at this time. For every impact of an aerodynamically energized grain, there are several hundred grains ejected into the wind for the high-energy transport that might occur on Mars. Many of these grains will themselves become subject to the boundary layer’s aerodynamic lift forces (their motion will not immediately die and add to the creep population), and these grains will become indistinguishable from those lifted entirely by aerodynamic forces. As each grain impacts the bed, it will eject even more grains into the flow. A cascading effect will take place, but because it must be finite in its growth, damping will occur as the number of grains set in motion causes mid-air collisions that prevent much of the impact energy from reaching the surface of the bed -thus creating a dynamic equilibrium in a high-density saltation cloud. It is apparent that for a given impact energy, the stress field permits a smaller volume of grains to convert to open packing as the size of the bed grains increases, or as the energy of the ”percussive” grain decreases (by decrease in velocity or mass). Thus, the mass of the ”repercussive” grain population that is ejected from the impact site becomes a function of the scale of the stress field in relation to the scale of the bed material (self-similarity being applicable if both bed size and energy are simultaneously adjusted). In other words, in a very high energy aeolian system where an aerodynamically raised grain can ballistically raise many more grains, the amount of material lifted into the wind becomes largely a function of a dilatancy threshold. If this threshold is exceeded, grains are repercussively injected into the saltation cloud. The ”dilatancy threshold” may be defined in terms of the saltation percussive force required to convert the bed, through elastic response, from a closed to an open packing system. If open packing cannot be created, the grains cannot escape from the impact site, even though the elastic deformation and percussive force may be able to reorganize the grains with respect to one another. As the crossbow experiments showed, for an ever-increasing bed grain size, a point is reached when no material can be moved because the energy of the percussive grain is insufficient to dilate the relatively coarse bed. Although this seems to be stating the obvious -- that too little energy will not cause the bed to splash -- the consequences of exceeding the ”splash threshold” by dilatancy are not so obvious for high-energy aeolian transport. It is noted that the force required to elastically dilate the bed has to overcome Coulombic grain attractions such as dipole-dipole coupling, dielectric, monopole, contact-induced dipole attractions, van der Waals forces, molecular monolayer capillary forces, as well as the mechanical interlocking frictional resistance of the grains. On Mars, it is predicted that the dilatancy threshold may be the prime control of grain flux. Additional information is contained in the original.
Author

Aerodynamic Forces; Mars (Planet); Sands; Sediment Transport; Wind Effects; Dust Storms; Stretching

20000025362 Search for Extraterrestrial Intelligence Inst., Moffett Field, CA USA

Unique Aeolian Transport Mechanisms on Mars: Respective Roles of Percussive and Repercussive Grain Populations in the Sediment Load

Marshall, John R., Search for Extraterrestrial Intelligence Inst., USA; Studies of Mineralogical and Textural Properties of Martian Soil: An Exobiological Perspective; September 1999, pp. 21; In English; Sponsored by American Geological Union, USA; See also 20000025351

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Experiments show that when sand-size grains impact a sediment surface with energy levels commensurate for Mars, small craters are formed by the ejection of several hundred grains from the bed. The experiments were conducted with a modified crossbow in which a sand-impelling sabot replaced the bolt-firing mechanism. Individual grains of sand could be fired at loose sand targets to observe ballistic effects unhindered by aerodynamic mobilization of the bed. Impact trajectories simulated the saltation process on dune surfaces. Impact craters were not elongated despite glancing (15 deg.) bed impact; the craters were very close to being circular. High-speed photography showed them to grow in both diameter and depth after the impactor had ricochetted from the crater site. The delayed response of the bed was ”explosive” in nature, and created a miniature ejecta curtain spreading upward and outward for many centimeters for impact of 100-300 micron-diameter grains into similar material. This behavior is explained by deposition of elastic energy in the bed by the ”percussive” grain. Impact creates a subsurface stress regime or ”quasi-Boussinesq” compression field. Elastic recovery of the bed occurs by dilatancy; shear stresses suddenly convert the grains to open packing and they consequently become forcefully ejected from the site. Random jostling of the grains causes radial homogenization of stress vectors and a resulting circular crater. A stress model based on repercussive bed dilatancy and interparticle adhesive forces (for smaller grains) predicts, to first order, the observed crater volumes for various impact conditions. On earth, only a few grains are mobilized by a percussive saltating grain; some grains are ”knudged” along the ground, and some are partly expelled on short trajectories. These motions constitute reptation transport. On Mars, saltation and reptation become indistinct: secondary or ”repercussive” trajectories have sufficient vertical impulse to create a dense saltation population of many tens or hundreds of grains for each single high-speed saltation percussion of the bed. Impact cascading will lead to near-surface distortion of the boundary layer, and choked flow formed by a dense ”slurry” of sand, with the majority of grains mobilized by repercussive forces rather than by aerodynamic lift. This proceeds until a fully-matured transport layer imposes self- limitations as grain-population density constrains the free-path motion of individual grains.

Author

Ejecta; Sands; Sediment Transport; Wind Effects; Mars (Planet); Mars Atmosphere; Mars Environment

20000025363 Search for Extraterrestrial Intelligence Inst., Moffett Field, CA USA

”Electrostructural Phase Changes” In Charged Particulate Clouds: Planetary and Astrophysical Implications

Marshall, J. R., Search for Extraterrestrial Intelligence Inst., USA; Studies of Mineralogical and Textural Properties of Martian Soil: An Exobiological Perspective; September 1999, pp. 24-26; In English; 29th; Lunar and Planetary Science, 16-20 Mar. 1998, Houston, TX, USA; See also 20000025351

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There is empirical evidence that freely-suspended triboelectrostatically charged particulate clouds of dielectric materials undergo rapid conversion from (nominally) monodispersed ”aerosols” to a system of well-defined grain aggregates after grain motion or fluid turbulence ceases within the cloud. In USA Microgravity Laboratory Space Shuttle experiments USML-1 and USML-2, it was found that ballistically-energized grain dispersions would rapidly convert into populations of filamentary aggregates after natural fluid (air) damping of grain motion. Unless continuously disrupted mechanically, it was impossible to maintain a non-aggregated state for the grain clouds of sand-size materials. Similarly, ground- based experiments with very fine dust-size material produced the same results: rapid, impulsive ”collapse” of the dispersed grains into well-defined filamentary structures. In both ground-based and microgravity experiments, the chains or filaments were created by long-range dipole electrostatic forces and dipole-induced dielectric interactions, not by monopole interactions. Maintenance of the structures was assisted by short-range static boundary adhesion forces and van der Waals interactions. When the aggregate containers in the USML experiments were disturbed after aggregate formation, the quiescently disposed filaments would rearrange themselves into fractal bundles and tighter clusters as a result of enforced encounters with one another. The long-range dipole interactions that bring the grains together into aggregates are a product of randomly-distributed monopole charges on the grain surfaces. In computer simulations, it has been shown that when the force vectors of all the random charges (of both sign) on a grain are resolved mathematically by assuming Coulombic interaction between them, the net result is a dipole moment on individual grains, even though the grains are electrically neutral insofar as there is no predominance, on their surface, of one charge sign over another. The random charges of both sign derive from natural grain-to-grain interactions that produce triboelectrification via charge exchange every time grain surfaces make contact with one another. The conversion from a random distribution of grains (upon

which there are randomly distributed charges) into an organization of electrostatically-ordered aggregates, can be regarded (within the framework of granular-material science) as an ”electrical or Coulombic phase change” of the particulate cloud. It is not totally dissimilar from the more normal phase-change concept in which, for example, a gas with long free-path-molecules suddenly becomes a solid as a result of structural ordering of the molecules (notably, also the result of electronic forces, albeit at a different scale). In both the gas-to-solid case, and the aerosol-to-aggregate case, the same materials and charges are present before and after the phase change, but their arrangement now has a higher degree of order and a lower-energy configuration. An input of energy into the system is required to reverse the situation. The aggregates in the USML experiments were observed to undergo at least two phase changes as noted above. The point about phase changes, and by implication, the ”electrostructural” reorganizations in particulate clouds, is the following: (a) they can occur very rapidly, almost spontaneously, above a critical cloud density, (b) in going from a higher energy state to a lower energy state, they convert to a denser system, (c) energy must be required to reverse the situation, implying that energy is released during the high-to-low energy phase change. In applying this information to natural particulate clouds, some inferences can be made (it is stressed that reference is still to dielectric materials attracted by dipole forces). There are several natural settings to which the USML observations apply, and to which the phase-change implications likewise apply. Dense clouds of triboelectrically-charged, kinetically-energized grains are to be found in volcanic eruptions (particularly on earth), aeolian dust storms (particularly on Mars), meteorite impact ejecta curtains (on all planets), in ”immature” debris rings around planets (e.g., that from which our own Moon may have condensed), and in gravitationally collapsing protoplanetary dust/planetesimal debris disks where dielectric granules are being increasingly brought into collisional relationships with one another (increasing both charge exchange and physical proximity). It is noted that in many of these cases, the degree of electrical charging on the grains is likely to be much higher than that in the USML experiments where charging was not enhanced above the ”normal”, naturally encountered level for the particular materials (quartz, glass, and various silicate minerals). Application of the phase-change concept suggests that volcanic, aeolian, and impact debris clouds may, under certain circumstances, undergo rapid, impulsive, or even catastrophic collapse into a denser state that will lead to rapid precipitation or fall-out of suspended particulates. Although this idea has been suggested previously by the author , the phase change concept possibly permits some new insights into cloud-system behavior. For example, in a protoplanetary debris disk, the work of gravity may suddenly be enhanced by electrostatically driven collapse of the system when materials reach a critical intergranular spacing or grain number density. This might reduce the rate of planet formation by orders of magnitude (considering the ratio of g-forces to electrostatic ones for very small grains in close proximity), and indeed, it might drive the collapse into a system configuration that would perhaps not be created by gravity alone. Additional information is contained in the original.
Author
Dipole Moments; Dust; Electrostatics; Grain Size; Aggregates

20000025364 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Diagnostic Clast-Texture Criteria for Recognition of Impact Deposits
Marshall, J. R., Search for Extraterrestrial Intelligence Inst., USA; Bratton, C., Search for Extraterrestrial Intelligence Inst., USA; Pope, K. O., Geo Eco Arc Research, USA; Ocampo, A. C., Jet Propulsion Lab., California Inst. of Tech., USA; Studies of Mineralogical and Textural Properties of Martian Soil: An Exobiological Perspective; September 1999, pp. 27-29; In English; 29th; Lunar and Planetary Science, 16-20 Mar. 1998, Houston, TX, USA; See also 20000025351
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It is difficult to find definitive evidence for impact in the geological record because there are many endogenous geological processes that can produce diamictites similar to those generated by impact ejecta. The classic impact criteria of shock fabrics in certain minerals, and iridium layers, for example, may be either difficult to find, or long-since erased from the impact site (shock fabrics also anneal with time). It is important to be able to recognize impact-generated materials in order to understand earth’s crustal development and biological evolution. In future exploration of Mars and other solar-system bodies, recognition of impact materials will be important for elucidating planetary evolution, planetary volatile inventories, and exobiological issues. The cobble depicted is typical of many that have been found in diamictite deposits in Belize generated by the Chicxulub K-T impact event. The pebbles are roughly-hewn in general shape with smoothed corners and edges. Surfaces are almost uniformly frosted (on both protuberances and hollows), but some asperities are glazed. Optical microscopy and thin-section petrographic microscopy reveal the frosting to be only a few microns thick, with a well-defined granular structure; grains are the same size as those composing the bulk of the limestone, but their clearer appearance may represent annealing. One or two adjacent pebble faces are often decorated with striated gouges and closely-spaced hemispherical depressions representing indentation hollows produced by well-rounded impacting clasts of up to 0.5 cm in diameter. Some of the impactors are still embedded in the cobble surface. Non-destructive x-ray diffraction techniques showed the impactors to be of the same mineralogy as the target cobble. We believe this unusual glazing and frosting to be related to the impact event, but this must be reconciled with its survival for over 60 my. since it is composed of one of the most alterable substances, $CaCO_3$. We focus, however, on the non-fractured rounded pebbles

that appear to have impacted the larger cobble as a swarm of clasts, probably encountered during ballistic flight. It cannot be defined whether the cobble swept through the pebble cloud, or the pebbles rained upon a slowermoving cobble. Two interesting questions arise: (1) Where did large numbers of such well rounded pebbles come from in the ejecta curtain?, and (2) How did they embed themselves in a nominally brittle rock without suffering damage? Are the well-rounded pebbles crystalline (devitrified) melt spherules? Further investigations are in progress. If the cobble was cold and brittle, impact of well-rounded pebbles would have produced Hertzian fracture patterns (a) in the virtually elastically isotropic cobble target. For penetration depths of about 0.5 of the impactor diameter, the pebbles would require a relative impact velocity sufficient to cause pebble fragmentation and crushing, and the development of a complex Hertzian-Boussinesq fracture field (b) involving deep fracturing and lateral surface spalling (impact velocities is greater than 50 m/s). The existing relationship could only evolve by the impact of cold, hard pebbles into a soft, plastic cobble surface (c). For limestone to have been plastic, it must have been at elevated temperature, but to prevent calcification of the material, the ambient pressure must also have been elevated. This would be possible either in the impact's gas plume, or within the confines of a thin aerodynamically-produced shock bow generated by supersonic ballistic motion of the cobble. In the latter case, it is implied that the cobble swept through the pebbles rather than vice-versa. Although there are high T-P conditions associated with volcanism, such textures have not been reported on volcaniclastic materials, nor from other high T-P environments; e.g., metamorphic (as far as the authors are aware). We propose that this very easily recognizable embedding and indentation surface texture can be used as a diagnostic criterion for the recognition of impact ejecta. The term "peening texture" is suggested, because it is absolutely analogous to the plastic-deformation induced, metal-surface textures generated by ball-bearing bombardment used in engineering metallurgy to work-harden metal surfaces. Additional information is contained in the original (Figures).
Author
Ejecta; Embedding; Impactors; Petrography; Planetary Crusts; Impact Damage

20000025365 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Strategies and Technologies for In Situ Mineralogical Investigations on Mars
Marshall, J. R., Search for Extraterrestrial Intelligence Inst., USA; Bratton, C., Search for Extraterrestrial Intelligence Inst., USA; Koppel, L., Oryx Technology Corp., USA; Hecht, M., Jet Propulsion Lab., California Inst. of Tech., USA; Metzger, E., San Jose State Univ., USA; Studies of Mineralogical and Textural Properties of Martian Soil: An Exobiological Perspective; September 1999, pp. 33-35; In English; 29th; Lunar and Planetary Science, 16-20 Mar. 1998, Houston, TX, USA; See also 20000025351
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Surface landers on Mars (Viking and Pathfinder) have not revealed satisfying answers to the mineralogy and lithology of the planet's surface. In part, this results from their prime directives: Viking focused on exobiology, Pathfinder focused on technology demonstration. The analytical instruments on board the landers made admirable attempts to extract the mineralogy and geology of Mars, as did countless modeling efforts after the missions. Here we suggest a framework for elucidating martian, or any other planetary geology, through an approach that defines (a) type of information required, (b) explorational strategy harmonious with acquisition of these data, (c) interpretation approach to the data, (d) compatible mission architecture, (e) instrumentation for interrogating rocks and soil. (a) Data required: The composition of a planet is ordered at scales ranging from molecules to minerals to rocks, and from geological units to provinces to planetary-scale systems. The largest ordering that in situ compositional instruments can attempt to interrogate is rock type "aggregate" information. This is what the geologist attempts to identify first. From this, mineralogy can be either directly seen or inferred. From mineralogy can be determined elemental abundances and perhaps the state of the compounds as being crystalline or amorphous. Knowledge of rock type and mineralogy is critical for elucidating geologic process. Mars landers acquired extremely valuable elemental data, but attempted to move from elements to aggregates, but this can only be done by making many assumptions and sometimes giant leaps of faith. Data we believe essential are elements, minerals, degree of ordering of compounds, and the aggregate or rock type that these materials compose. (b) Explorational strategy: A lander should function as a surrogate geologist. Of the total landscape, a geologist sees much, but gives detailed attention to an infinitesimally small amount of what is seen. to acquire samples worth detailed scrutiny, as many samples as possible need examining at a cursory or reconnaissance level. A representative, statistically-meaningful sample number cannot be overemphasized. This maxim still applies to geological exploration of our own planet of which we have abundant knowledge. Analysis of many samples mandates low-power consumption per sample. (c) Data interpretation: No single instrument can analyze the full spectrum of the x-axis. An instrument is optimized for detecting certain material characteristics and must therefore affix itself to some point on the x-axis. Any conclusions drawn about data to the left or right of the instrument's position on this axis must necessarily be derived by inference. Hence, it seems logical to include on a mission, instruments that are not closely spaced in their x-axis-position, and if only two analytical methods are used, as shown, they should start at opposite ends of the axis and work towards the center. As examples, we depict a high-resolution camera to evaluate rock type ("aggregate" state) and mineralogy, and an x-ray diffractometer-fluorescence spectrometer (XRD-XRF) to determine elements, minerals, and the degree

of order of materials. (d) Mission architecture: No instrument or suite of instruments can be relied upon to always give truly unequivocal analyses. The suite of instruments should therefore permit conclusions of one instrument to be checked against those of another through closed analytical loops. These ”loops” can be structured by a combination of orbital imagery, descent imagery, broad-band site viewing/analysis, and data that cover both x and y axes. For example, the detection of a basaltic-looking rock with a microscope should be checked against the elements detected, the appearance of the rock as a lava flow from descent imagery, and so forth. (e) Instrumentation: to satisfy the above criteria, it is necessary to: (i) See the rock or soil with high resolution + magnification, (ii) Examine many samples, (iii) Consume little power per analysis, (iv) Determine elemental species, (v) Determine mineralogy directly (not inferentially) and the degree of ordering of compounds, (vi) Start analyzing from both ends of the x-axis. Every geologist wants to see the hand sample first, and apply a hand lens to its surface. This has not been the starting point for missions to Mars. Thus, our technology satisfies all these criteria . This XRD-XRF-Optical instrument currently being developed, analyses rock or soil surfaces without the need for sample acquisition or preparation; this satisfies the power criterion, and enables many analyses. The device acquires direct mineralogy and determines elemental species. The embedded endoscopic camera satisfies the critical criterion of close inspection of samples; the fiber optic cable can also be used for IR, LTV, or laser sample analysis. Additional information is contained in the original (Figures).
Author
Mars (Planet); Mars Surface; Planetary Geology; Mission Planning; Optical Equipment

20000025366 Search for Extraterrestrial Intelligence Inst., Moffett Field, CA USA
”Coulombic Viscosity” In Granular Materials: Planetary and Astrophysical Implications
Marshall, J. R., Search for Extraterrestrial Intelligence Inst., USA; Studies of Mineralogical and Textural Properties of Martian Soil: An Exobiological Perspective; September 1999, pp. 36-37; In English; 29th; Lunar and Planetary Science, 16-20 Mar. 1998, Houston, TX, USA; See also 20000025351
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The term ”Coulombic viscosity” is introduced here to define an empirically observed phenomenon from experiments conducted in both microgravity, and in ground-based 1-g conditions. In the latter case, a sand attrition device was employed to test the longevity of aeolian materials by creating two intersecting grain-circulation paths or cells that would lead to most of the grain energy being expended on grain-to-grain collisions (simulating dune systems). In the areas in the device where gravitationally-driven grain-slurries recycled the sand, the slurries moved with a boundary-layer impeded motion down the chamber walls. Excessive electrostatic charging of the grains during these experiments was prevented by the use of an a.c. corona (created by a Tesla coil) through which the grains passed on every cycle. This created both positive and negative ions which neutralized the triboelectrically-generated grain charges. When the corona was switched on, the velocity of the wall-attached slurries increased by a factor of two as approximately determined by direct observation. What appeared to be a freely-flowing slurry of grains impeded only by intergranular mechanical friction, had obviously been significantly retarded in its motion by electrostatic forces between the grains; with the charging reduced, the grains were able to move past one another without a flow ”viscosity” imposed by the Coulombic intergranular forces. A similar phenomenon was observed during microgravity experiments aboard Space Shuttle in USML-1 & USML-2 spacelabs where freely-suspended clouds of sand were being investigated for their potential to for-m aggregates. In this environment, the grains were also charged electrostatically (by natural processes prior to flight), but were free from the intervention of gravity in their interactions. The grains were dispersed into dense clouds by bursts of air turbulence and allowed to form aggregates as the ballistic and turbulent motions damped out. During this very brief (30-60 sec) damping period, motion of the grains was observed to be retarded by the electrostatic interactions. The fact that the grains almost instantly formed aggregates was evidence that their ballistic motions had been constrained and redirected by the dipole-dipole interactions that led to filamentary aggregate development. Undoubtedly, the ”Coulombic viscosity” of the cloud assisted in damping grain motion so rapidly. The electrostatically-induced grain-cloud viscosity or drag exerted on grain motion, is a complex function of three major parameters: charge magnitude, charge sign, and mean intergranular distance. The above experiments illustrate one particular type of granular behavior. The discussion here will therefore be restricted to drag relationships: (a) between grains that are naturally charged triboelectrically and thus exhibit dipole-dipole attractions between one another even if there are slight net charges present (which can be overwhelmed by dipole coupling at short distances), and (b) between grains that are densely spaced where the intergranular distance varies between zero and some value (usually tens or hundreds of grain diameters) that permits each grain to detect the dipole moment of another grain -- the distance is not so great that other grains appears as neutral electrical ”singularities. I. Aeolian transport: During motion of grains in a saltation cloud (on Earth, Mars, or Venus), triboelectric charging must occur as a result of multiple grain contacts, and by friction with the entraining air. A situation might develop that is similar to the one described above in the attrition device: grain motion becoming significantly retarded (reduced flux) as grains find it increasingly difficult to either separate from the surface, or to pass one another without Coulombic retarding forces. A ”Coulombic drag” will exist at flux initiation and increase with time to work in direct opposition

to the aerodynamic drag that drives the grain motion. It is predicted that this will lead to an increase with time of both the aerodynamic and bed-dilatancy thresholds (3). Because of Paschen discharge effects in the martian atmosphere, the electrostatic charging in a saltation cloud may be partially abated, but this will lead to greater grain mobility, more charging, and thus to a charge-discharge steady state mediated by mechanical interactions. II. Dry colluvial systems: Sand avalanches on dunes, dry debris flows, talus flows, avalanches, and pyroclastic surges are examples of gravity-driven, dense granular flows where rock/grain fragmentation and grain-to-grain interactions cause triboelectrification (sometimes augmented by other electrical charging processes), and where the grain densities of the systems are such that strong dipole-dipole interactions between grains might be expected to be present. Because it is expected that the Coulombic forces between grains will cause a sluggishness or enhanced granular-flow viscosity, the motion of a grain mass will be retarded or damped so that this will assist, ultimately, in terminating the flow. The greatest Coulombic viscosity will be created in the most highly charged systems, which will also be the most energetic. Thus, grain flows have some tendency to be self-limiting by internal energy partitioning; gravitational potential is converted to Coulombic potential, which manifests itself as a drag force between the grains. III. Volcanic eruption plumes and impact ejecta curtains: The violence of these systems leads to powerful electrical charging of particulates. Lightning storms emanating from volcanic plumes are a testimony to the levels of charging. As pyroclastic grains interact forcefully and frequently within eruption plumes, it is reasonable to predict that the internal turbulent motions of the plume will be significantly damped by the Coulombic viscosity exerted by grain charges. Additional information is contained in the original.
Author
Dipole Moments; Electrostatics; Gravitational Effects; Sands; Viscosity; Dust Storms; Wind Effects; Planetary Geology; Electric Charge

20000025367 Search for Extraterrestrial Intelligence Inst., Moffett Field, CA USA
Dust on Mars: An Aeolian Threat to Human Exploration?
Marshall, J., Search for Extraterrestrial Intelligence Inst., USA; Studies of Mineralogical and Textural Properties of Martian Soil: An Exobiological Perspective; September 1999, pp. 38; In English, 1998, San Francisco, CA, USA; Sponsored by American Geophysical Union, USA; See also 20000025351
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The NASA HEDS Program is duly concerned for human explorers regarding the potential hazard posed by the ubiquitous dust mantle on Mars. to evaluate properties of dust that could be hazardous to humans, the NMS 2001 Lander payload will include the Mars Environmental Compatibility Assessment (MECA) experiment. This includes optical and atomic-force microscopy to evaluate soil grains for shape and size, wet chemistry to evaluate toxic substances, electrometry to evaluate triboelectric charging, and test-material palets to evaluate electrostatic and magnetic adhesion, and the hardness/abrasiveness of soil grains; these experimental subcomponents are delivered samples by the camera-equipped robotic arm of the lander which will acquire material from depths of 0.5 to 1.0 m in the soil. Data returned by MECA will be of value to both the hEDS and planetary/astrobiology communities. Dust poses a threat to human exploration because the martian system does not hydrologically or chemically remove fine particles that are being continuously generated by thermal, aeolian, and colluvial weathering, and by volcanism and impact over billions of years. The dust is extremely fine-grained, in copious quantities, ubiquitous in distribution, continually mobile, and a source of poorly-grounded static charges -- a suite of characteristics posing a particulate and electrical threat to explorers and their equipment. Dust is mobilized on global and regional scales, but probably also unpredictably and violently at local scales by dust devils. The latter might be expected in great abundance owing to near surface atmospheric instability (dust devils were detected by Pathfinder during its brief lifetime). Preliminary laboratory experiments suggest that space-suit materials subjected to windblown dust may acquire a uniform, highly adhesive dust layer that is also highly cohesive laterally owing to electrostatic forces. This layer will obscure visibility through the helmet visor, penetrate joints and fabrics, change the thermal properties of the suit, and possibly affect electronic/electrical suit functions. It is paramount that future missions address the issue of interparticle forces, and in particular, the role played by ionizing radiation in affecting these forces on Mars.
Author
Dust; Mars (Planet); Particulates; Wind Effects; Dust Storms; Manned Mars Missions; Mars Environment

20000025368 Washington Univ., Dept. of Earth and Planetary Sciences, Saint Louis, MO USA
Compositional Analysis of Martian Soil: Synergism of APEX and MECA Experiments on MPS 2001
Arvidson, R., Washington Univ., USA; Marshall, J., Search for Extraterrestrial Intelligence Inst., USA; Studies of Mineralogical and Textural Properties of Martian Soil: An Exobiological Perspective; September 1999, pp. 39; In English, 1998, San Francisco, CA, USA; Sponsored by American Geophysical Union, USA; See also 20000025351
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The APEX (ATHENA Precursor Experiment) payload for the Mars 2001 mission will analyze soil and dust with a multispectral panoramic imager and an emission spectrometer on a mast on the lander, a Moessbauer spectrometer on the lander robotic arm (RA), and APXS measurements on the Marie Curie rover. These analytical methods will provide data on elemental abundances and mineralogy. The MECA payload on the lander will apply microscopy, AFM, wet chemistry, adhesive substrates, and electrometry to determine the shape and size of particles in the soil and dust, the presence of toxic substances, and electrostatic, magnetic, and hardness qualities of particles. The two experiments will complement one another through several interactions: (1) The panoramic imager provides the geological setting in which both APEX and MECA samples are acquired, (2) The RA provides samples to MECA from the surface and subsurface and will permit APEX analytical tools access to materials below the immediate surface, (3) Comparisons can be made between elemental analyses of the Moessbauer, IR, APXS on APEX and the wet chemistry of MECA which will define trace elements (ionic species in solution) and soil redox potential and conductivity. (4) APEX bulk compositional measurements will place MECA trace measurements in context, and similarly, MECA microscopy will provide particle size data that may correlate with compositional differences determined by the APEX instruments. Additionally, lithic fragments viewed by the MECA microscope station should correlate with mineral/rock species inferred by APEX data, (5) If APEX instruments detect quartz for example, the scratch plates of the MECA microscope stage will define if a mineral of this hardness is registered during abrasion tests. This is by no means an exhaustive list of potential interactions, but it is clear that both the sheer number of analytical techniques and their complementarity should provide an analytically powerful capability for both planetary and HEDS communities.

Author

Mars (Planet); Mineralogy; Soils; Dust; Mars Surface; Mars Surveyor 2001 Mission

20000025369 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Mars Environmental Compatibility Assessment (MECA): Identifying the Hazards of the Martian Soil

Meloy, T. P., West Virginia Univ., USA; Hecht, M. H., Jet Propulsion Lab., California Inst. of Tech., USA; Anderson, M. S., Jet Propulsion Lab., California Inst. of Tech., USA; Frant, M. A., Orion Research, Inc., USA; Fuerstenau, S. D., Jet Propulsion Lab., California Inst. of Tech., USA; Keller, H. U., Max-Planck-Inst. fuer Aeronomie, Germany; Markiewicz, W. J., Max-Planck-Inst. fuer Aeronomie, Germany; Marshall, J., Search for Extraterrestrial Intelligence Inst., USA; Pike, W. T., Jet Propulsion Lab., California Inst. of Tech., USA; Quate, C. F., Stanford Univ., USA; Studies of Mineralogical and Textural Properties of Martian Soil: An Exobiological Perspective; September 1999, pp. 40; In English, 1998, Unknown; Sponsored by Mars Society, USA; See also 20000025351

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Sometime in the next decade NASA will decide whether to send a human expedition to explore the planet Mars. The Mars Environmental Compatibility Assessment (MECA) has been selected by NASA to evaluate the Martian environment for soil and dust hazards to human exploration. The integrated MECA payload contains three elements: a wet-chemistry laboratory, a microscopy station, and enhancements to a lander robot-arm system incorporating arrays of material patches and an electrometer to identify triboelectric charging during soil excavation. The wet-chemistry laboratory will evaluate samples of Martian soil in water to determine the total dissolved solids, redox potential, pH, and quantify the concentration of many soluble ions using ion-selective electrodes. These electrodes can detect potentially dangerous heavy-metal ions, emitted pathogenic gases, and the soil's corrosive potential. MECA's microscopy station combines optical and atomic-force microscopy with a robot-arm camera to provide imaging over nine orders of magnitude, from meters to nanometers. Soil particle properties including size, shape, color, hardness, adhesive potential (electrostatic and magnetic), will be determined on the microscope stage using an ar-ray of sample receptacles and collection substrates, and an abrasion tool,. The simple, rugged atomic-force microscope will image in the submicron size range and has the capability of performing a particle-by-particle analysis of the dust and soil. Although selected by NASA's Human Exploration and Development of Space Enterprise, the MECA instrument suite also has the capability to address basic geology, paleoclimate, and exobiology issues. To understand both contemporaneous and ancient processes on Mars, the mineralogical, petrological, and reactivity of Martian surface materials should be constrained: the NMCA experiment will shed light on these quantities through its combination of chemistry and microscopy. On Earth, the earliest forms of life are preserved as microfossils. The atomic-force microscope will have the required resolution to image down to the scale of terrestrial microfossils and beyond.

Author

Dust; Hazards; Mars (Planet); Mars Environment; Mars Surface; Planetary Geology; Soils; Dust Storms; Mars Surveyor 2001 Mission; Mars Exploration

20000025370 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Origin and Reactivity of the Martian Soil: A 2003 Micromission

Yen, Albert S., Jet Propulsion Lab., California Inst. of Tech., USA; Kim, S. Sam, Jet Propulsion Lab., California Inst. of Tech., USA; Marshall, John, Search for Extraterrestrial Intelligence Inst., USA; Murray, Bruce C., California Inst. of Tech., USA; Studies of Mineralogical and Textural Properties of Martian Soil: An Exobiological Perspective; September 1999, pp. 41-44; In English; Mars Exploration Programme and Sample Return Mission, 1-5 Feb. 1999, Paris, France; See also 20000025351

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The role of water in the development of the martian surface remains a fundamental scientific question. Did Mars have one or more ”warm and wet” climatic episodes where liquid water was stable at the surface? If so, the mineral phases present in the soils should be consistent with a history of aqueous weathering. More generally, the formation of hydrated mineral phases on Mars is a strong indicator of past habitable surface environments. The primary purpose of this investigation is to help resolve the question of whether such aqueous indicators are present on Mars by probing the upper meter for diagnostic mineral species. According to Burns [1993], the formation of the ferric oxides responsible for the visible color of Mars are the result of dissolution of Fe (+2) phases from basalts followed by aqueous oxidation and precipitation of Fe” mineral assemblages. These precipitates likely included iron oxyhydroxides such as goethite (a-FeOOH) and lepidocrocite (g-FeOOH), but convincing evidence for these phases at the surface is still absent. The stability of these minerals is enhanced beneath the surface, and thus we propose a subsurface search for hydroxylated iron species as a test for a large-scale chemical weathering process based on interactions with liquid water. It is also possible that the ferric minerals on Mars are not aqueous alteration products of the rocks. A chemical study of the Pathfinder landing site concluded that the soils are not directly derived from the surrounding rocks and are enhanced in Mg and Fe. The additional source of these elements might be from other regions of Mars and transported by winds, or alternatively, from exogenic sources. Gibson [1970] proposed that the spectral reflectivity of Mars is consistent with oxidized meteoritic material. Yen and Murray [1998] further extend Gibson’s idea and show, in the laboratory, that metallic iron can be readily oxidized to maghemite and hematite under present-day martian surface conditions (in the absence of liquid water). A test for a meteoritic component of the soil can be conducted, as described below, by searching for the presence of Ni at the martian surface. The average abundance of nickel in an Fe-Ni meteorite is about 7% and, if present at measurable levels in the soil, would be indicative of an exogenic contribution. In addition, it may be possible to directly search for mineral phases common in meteorites. An understanding of the formation and evolution of the martian soil would not be complete without addressing the unusual reactivity discovered by the Viking Landers The presence of an inorganic oxidant, possibly one produced as a results of photochemical processes, is the most widely accepted explanation of the Viking results. Are these chemical species simply adsorbed on soil grains, or have they reacted with the metal oxide substrates and altered the mineral structures? Could a completely different (non-photochemical) process be responsible for the soil reactivity? The various ideas for the nature of this putative oxidant could be constrained by a measurement of the change in reactivity with depth. Different compositions will have different lifetimes and mobilities and thus will have different vertical profiles. Because the oxidizing compounds are believed to actively destroy organic molecules, determination of the reactivity gradient also has significant implications for the search for life on Mars. A DS2-based microprobe system can be instrumented for a 2003 micromission to investigate the origin and reactivity of the martian soil. These measurements would provide invaluable information regarding the climate history and exobiological potential of the planet. The NMR, X ray and chemiresistor measurement approach described embodies a highly synergistic and general set of soil interrogation methods for elements, compounds, and crystal structures and can also be applied to other geologic questions of interest. For example, if the capability for precise targeting of the probes is available, then in-situ investigations of suspected evaporite and hydrothermal deposits would be possible with the same set of instruments. Additional information is contained in the original.

Author

Mars (Planet); Mars Surface; Mineralogy; Soils; Water; Mars Environment

20000025371 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

The MSP 2001 Mars Environmental Compatibility Assessment (MECA)

Hecht, M. H., Jet Propulsion Lab., California Inst. of Tech., USA; Meloy, T. P., West Virginia Univ., USA; Anderson, M. S., Jet Propulsion Lab., California Inst. of Tech., USA; Buehler, M. G., Jet Propulsion Lab., California Inst. of Tech., USA; Frant, M. A., Orion Research, Inc., USA; Grannan, S. M., Jet Propulsion Lab., California Inst. of Tech., USA; Fuerstenau, D., Jet Propulsion Lab., California Inst. of Tech., USA; Keller, H. U., Max-Planck-Inst. fuer Aeronomie, Germany; Markiewicz, W. J., Max-Planck-Inst. fuer Aeronomie, Germany; Marshall, J., Search for Extraterrestrial Intelligence Inst., USA; Studies of Mineralogical and Textural Properties of Martian Soil: An Exobiological Perspective; September 1999, pp. 45-46; In English; Mars Exploration Programme and Sample Return Mission, 1-5 Feb. 1999, Paris, France; See also 20000025351

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The Mars Environmental Compatibility Assessment (MECA) will evaluate the Martian environment for soil and dust-related hazards to human exploration as part of the Mars Surveyor Program 2001 Lander. Sponsored by the Human Exploration and Development of Space (HEDS) enterprise, MECA's goal is to evaluate potential geochemical and environmental hazards that may confront future martian explorers, and to guide HEDS scientists in the development of high fidelity Mars soil simulants. The integrated MECA payload contains a wet-chemistry laboratory, a microscopy station, an electrometer to characterize the electrostatics of the soil and its environment, and arrays of material patches to study the abrasive and adhesive properties of soil grains. The instrument will acquire soil samples with a robotic arm equipped with a camera. MECA will examine surface and subsurface soil and dust in order to characterize particle size, shape, hardness, and also physical characteristics that may provide clues to mineralogy. MECA will characterize soil/water mixtures with respect to pH, redox potential, total dissolved ions, and trace toxins. MECA will determine the nature of electrostatic charging associated with excavation of soil, and the influence of ionizing radiation on material properties. It will also observe natural dust accumulation on engineering materials. to accomplish these objectives, MECA is allocated a mass of 10 kg within an enclosure of 35 x 25 x 15 cm. The Wet Chemistry Laboratory (WCL) consists of four identical cells that will accept samples from surface and subsurface regions accessible to the Lander's robotic arm, mix them with water, and perform extensive analysis of the solution. Ion-selective electrodes and related sensors will evaluate total dissolved solids, redox potential, pH, and the concentration of many soluble ions and gases in wet Martian soil. These electrodes can detect potentially dangerous heavy-metal ions, emitted pathogenic gases, and the soil's corrosive potential. Experiments will include cyclic voltammetry and anodic stripping voltammetry. Complementary to the Viking experiments, the chemical laboratory will characterize the water-soil solution rather than emitted gases. Nonetheless, through analysis of dissolved gases it will be able to replicate many of the Viking observations related to oxidants. MECA's microscopy station combines optical and atomic-force microscopy (AFM) in an actively focused, controlled illumination environment to image particles from millimeters to nanometers in size. Careful selection of substrates allows controlled experiments in adhesion, abrasion, hardness, aggregation, magnetic and other properties. Special tools allow primitive manipulation (brushing and scraping) of samples. Soil particle properties including size, shape, color, hardness, adhesive potential (electrostatic and magnetic), will be determined using an array of sample receptacles and collection substrates. The simple, rugged atomic-force microscope wil image in the submicron size range and has the capability of performing a particle-by-particle analysis of the dust and soil. On Earth, the earliest forms of life are preserved as microfossils. The atomic-force microscope will have the required resolution to image down to the scale of terrestrial microfossils and beyond. Mounted on the end of the robot arm, MECA's electrometer actually consists of four types of sensors: an electric field meter, several triboelectricity monitors, an ion gauge, and a thermometer. Tempered only by ultraviolet-light-induced ions and a low-voltage breakdown threshold, the dry, cold, dusty martian environment presents an imposing electrostatic hazard to both robots and humans. The field meter will measure the ambient field on nearby objects while the triboelectric sensors, using identical circuitry, will measure the charge accumulated on test substances as they are dragged through the soil by the arm. The ion chamber, open to the environment, will sense both charged dust and free ions in the air. Over and above the potential threat to electronics, the electrostatic environment holds one of the keys to transport of dust and, consequently, martian meteorology. Viewed with the robot arm camera, the abrasion and adhesion plates are strategically placed to allow direct observation of the interaction between materials and soils on a macroscopic scale. Materials of graded hardness are placed directly under the robot arm scoop to sense wear and soi hardness. A second array, placed on the lander deck, is deployed after the dust plume of landing has settled. It can be manipulated in a primitive fashion by the arm, first having dirt deposited o it from the scoop and subsequently shaken clean. A third array will passively collect dust from the atmosphere. In addition to objectives related to human exploration, the MECA data set will be rich in information relevant to basic geology, paleoclimate, and exobiology issues. to understand both contemporaneous and ancient processes on Mars, the mineralogy, petrology, and reactivity of Martian surface materials should be constrained. The MECA experiment will shed light on these quantities through its combination of chemistry and microscopy. MECA will be capable of measuring the composition of ancient surface water environments, observing microscopic evidence of geological (and biological?) processes, inferring soil and dust transport, comminution and weathering mechanisms, and characterizing soil horizons that might be encountered during excavation.
Author

Dust; Mars (Planet); Mars Environment; Mars Surface; Mars Surveyor 2001 Mission; Robot Arms; Soils

20000025372 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Soil Analysis Micro-Mission Concepts Derived from the MSP 2001 Mars Environmental Compatibility Assessment (MECA)

Hecht, M. H., Jet Propulsion Lab., California Inst. of Tech., USA; Meloy, T. P., West Virginia Univ., USA; Anderson, M. S., Jet Propulsion Lab., California Inst. of Tech., USA; Buehler, M. G., Jet Propulsion Lab., California Inst. of Tech., USA; Frant, M. A., Orion Research, Inc., USA; Grannan, S. M., Jet Propulsion Lab., California Inst. of Tech., USA; Fuerstenau, S. D., Jet Propulsion Lab., California Inst. of Tech., USA; Keller, H. U., Max-Planck-Inst. fuer Aeronomie, Germany; Markiewicz, W. J.,

Max-Planck-Inst. fuer Aeronomie, Germany; Marshall, J., Search for Extraterrestrial Intelligence Inst., USA; Studies of Mineralogical and Textural Properties of Martian Soil: An Exobiological Perspective; September 1999, pp. 47; In English; Mars Exploration Programme and Sample Return Mission, 1-5 Feb. 1999, Paris, France; See also 20000025351

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The Mars Environmental Compatibility Assessment (MECA) will evaluate the Martian environment for soil and dust-related hazards to human exploration as part of the Mars Surveyor Program 2001 Lander. The integrated MECA payload contains a wet-chemistry laboratory, a microscopy station, an electrometer to characterize the electrostatic environment, and arrays of material patches to study abrasion and adhesion. Heritage will be all-important for low cost micro-missions, and adaptations of instruments developed for the Pathfinder, ’98 and ’01 Landers should be strong contenders for ’03 flights. This talk has three objectives: (1) Familiarize the audience with MECA instrument capabilities; (2) present concepts for stand-alone and/or mobile versions of MECA instruments; and (3) broaden the context of the MECA instruments from human exploration to a comprehensive scientific survey of Mars. Due to time limitations, emphasis will be on the chemistry and microscopy experiments. Ion-selective electrodes and related sensors in MECA’s wet-chemistry laboratory will evaluate total dissolved solids, redox potential, pH, and the concentration of many soluble ions and gases in wet Martian soil. These electrodes can detect potentially dangerous heavy-metal ions, emitted pathogenic gases, and the soil’s corrosive potential, and experiments will include cyclic voltammetry and anodic stripping. For experiments beyond 2001, enhancements could allow multiple use of the cells (for mobile experiments) and reagent addition (for quantitative mineralogical and exobiological analysis). MECA’s microscopy station combines optical and atomic-force microscopy (AFM) in an actively focused, controlled illumination environment to image particles from millimeters to nanometers in size. Careful selection of substrates allows controlled experiments in adhesion, abrasion, hardness, aggregation, magnetic and other properties. Special tools allow primitive manipulation (brushing and scraping) of samples. Soil particle properties including size, shape, color, hardness, adhesive potential (electrostatic and magnetic), will be determined using an array of sample receptacles and collection substrates. The simple, rugged atomic-force microscope will image in the submicron size range and has the capability of performing a particle-by-particle analysis of the dust and soil. Future implementations might enhance the optical microscopy with spectroscopy, or incorporate advanced AFM techniques for thermogravimetric and chemical analysis.

Author

Mars Environment; Mars Surface; Mars Surveyor 2001 Mission; Mission Planning; Manned Mars Missions; Measuring Instruments

20000025373 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

AFM Studies of Lunar Soils and Application to the Mars 2001 Mission

Weitz, C. M., Jet Propulsion Lab., California Inst. of Tech., USA; Anderson, M. S., Jet Propulsion Lab., California Inst. of Tech., USA; Marshall, J., Search for Extraterrestrial Intelligence Inst., USA; Studies of Mineralogical and Textural Properties of Martian Soil: An Exobiological Perspective; September 1999, pp. 48; In English; 4th, Jun. 1999, Boston, MA, USA; Sponsored by American Geological Union, USA; See also 20000025351

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The upcoming Mars 01 mission will carry an Atomic Force Microscope (AFM) as part of the Mars Environmental Compatibility Assessment (MECA) instrument. By operating in a tapping mode, the AFM is capable of sub-nanometer resolution in three dimensions and can distinguish between substances of different compositions by employing phase contrast imaging. to prepare for the Mars 01 mission, we are testing the AFM on a lunar soil to determine its ability to define particle shapes and sizes and grain-surface textures. The test materials are from the Apollo 17 soil 79221, which is a mixture of agglutinates, impact and volcanic beads, and mare and highland rock and mineral fragments. The majority of the lunar soil particles are less than 100 microns in size, comparable to the sizes estimated for martian dust. We have used the AFM to examine several different soil particles at various resolutions. The instrument has demonstrated the ability to identify parallel ridges characteristic of twinning on a 150 micron plagioclase feldspar particle. Extremely small (10-100 nanometer) adhering particles are visible on the surface of the feldspar grain, and they appear elongate with smooth surfaces. Phase contrast imaging of the nanometer particles shows several compositions to be present. When the AFM was applied to a 100 micron glass spherule, it was possible to define an extremely smooth surface; this is in clear contrast to results from a basalt fragment which exhibited a rough surface texture. Also visible on the surface of the glass spherule were chains of 100 nanometer and smaller impact melt droplets. For the ’01 Mars mission, the AFM is intended to define the size and shape distributions of soil particles, in combination with the NMCA optical microscope system and images from the Robot Arm Camera (RAC). These three data sets will provide a means of assessing potentially hazardous soil and dust properties. The study that we have conducted on the lunar soils now suggests that the NMCA experiment will be able to define grain transport and weathering processes. For example, it should be possible to determine if Martian grains have been subjected to aeolian or water transport, volcanic activity, impact melting processes, in-situ weathering,

and a host of other processes. Additionally, textural maturity could be assessed (via freshness and form of fracture patterns and grain shapes). Thus, the AFM has the potential to shed new light on Martian surface processes by adding the submicroscopic dimension to planetary investigations.
Author
Dust; Imaging Techniques; Lunar Soil; Mars (Planet); Mars Missions; Mars Surface; Soils

20000025375 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Mars 2001 Mission: Addressing Scientific Questions Regarding the Characteristics and Origin of Local Bedrock and Soil
Saunders, R. S., Jet Propulsion Lab., California Inst. of Tech., USA; Arvidson, R. E., Washington Univ., USA; Weitz, C. M., Jet Propulsion Lab., California Inst. of Tech., USA; Marshall, J., Search for Extraterrestrial Intelligence Inst., USA; Squyres, S. W., Cornell Univ., USA; Christensen, P. R., Arizona State Univ., USA; Meloy, T., West Virginia Univ., USA; Smith, P., Arizona Univ., USA; Studies of Mineralogical and Textural Properties of Martian Soil: An Exobiological Perspective; September 1999, pp. 52-53; In English; 30th; Lunar and Planetary Science, 15-19 Mar. 1999, Houston, TX, USA; See also 20000025351
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The Mars Surveyor Program 2001 Mission will carry instruments on the orbiter, lander and rover that will support synergistic observations and experiments to address important scientific questions regarding the local bedrock and soils. The martian surface is covered in varying degrees by fine materials less than a few mms in size. Viking and Pathfinder images of the surface indicate that soils at those sites are composed of fine particles. Wheel tracks from the Sojourner rover suggest that soil deposits are composed of particles is less than 40 mm. Viking images show that dunes are common in many areas on Mars and new MOC images indicate that dunes occur nearly everywhere. Dunes on Mars are thought to be composed of 250-500 microns particles based upon Viking IRTM data and Mars wind tunnel experiments. If martian dunes are composed of sand particles is greater than 100 microns and soils are dominated by is less than 10 micron particles, then where are the intermediate grain sizes? Have they been wom away through prolonged transport over the eons? Were they never generated to begin with? Or are they simply less easy to identify because do they not form distinctive geomorphic features such as dunes or uniform mantles that tend to assume superposition in the soil structure?
Author
Dunes; Mars (Planet); Mars Surface; Mars Surveyor 2001 Mission; Sands; Soils

20000025376 NASA Johnson Space Center, Houston, TX USA
Mars 2001 Lander Mission: Measurement Synergy Through Coordinated Operations Planning and Implementation
Arvidson, R., Washington Univ., USA; Bell, J. F., III, Cornell Univ., USA; Kaplan, D., NASA Johnson Space Center, USA; Marshall, J., Search for Extraterrestrial Intelligence Inst., USA; Mishkin, A., Jet Propulsion Lab., California Inst. of Tech., USA; Saunders, S., Jet Propulsion Lab., California Inst. of Tech., USA; Smith, P., Arizona Univ., USA; Squyres, S., Cornell Univ., USA; Studies of Mineralogical and Textural Properties of Martian Soil: An Exobiological Perspective; September 1999, pp. 54-55; In English; 30th; Lunar and Planning Science, 15-19 Mar. 1999, Houston, TX, USA; See also 20000025351
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The 2001 Mars Surveyor Program Mission includes an orbiter with a gamma ray spectrometer and a multispectral thermal imager, and a lander with an extensive set of instrumentation, a robotic arm, and the Marie Curie Rover. The Mars 2001 Science Operations Working Group (SOWG) is a subgroup of the Project Science Group that has been formed to provide coordinated planning and implementation of scientific observations, particularly for the landed portion of the mission. The SOWG will be responsible for delivery of a science plan and, during operations, generation and delivery of conflict-free sequences. This group will also develop an archive plan that is compliant with Planetary Data System (PDS) standards, and will oversee generation, validation, and delivery of integrated archives to the PDS. In this report we cover one element of the SOWG planning activities, the development of a plan that maximizes the scientific return from lander-based observations by treating the instrument packages as an integrated payload. Scientific objectives for the lander mission have been defined. They include observations focused on determining the bedrock geology of the site through analyses of rocks and also local materials found in the soils, and the surficial geology of the site, including windblown deposits and the nature and history of formation of indurated sediments such as duricrust. Of particular interest is the identification and quantification of processes related to early warm, wet conditions and the presence of hydrologic or hydrothermal cycles. Determining the nature and origin of duricrust and associated salts is -very important in this regard. Specifically, did these deposits form in the vadose zone as pore water evaporated from soils or did they form by other processes, such as deposition of volcanic aerosols? Basic information needed to address these questions includes the morphology, topography, and geologic context of landforms and materials exposed at the site, together with quantitative information on material mineralogy, chemistry, and physical properties (rock textures; soil grain size and shape distributions; degree and nature of soil induration; soil magnetic properties). The calibration targets provide radiometric and mineralogical control surfaces. The

magnets allow observations of magnetic phases. Patch plates are imaged to determine adhesive and abrasive properties of soils. Coordinated mission planning is crucial for optimizing the measurement synergy among the packages included on the lander. This planning has already begun through generation of multi-sol detailed operations activities. One focus has been to develop a scenario to use the arm to dig a soil trench to a depth of tens of centimeters. The activity will be monitored through use of Pancam and RAC to ensure nominal operations and to acquire data to determine subsurface physical properties (e.g., angle of repose of trench walls). Pancam and Mini-TES observations would also provide constraints on mineralogy and texture for the walls and bottom of the trench during excavation. If desired, soils excavated at depth could be deposited on the surface and Mossbauer and APXS measurements could be acquired for these materials. Soil samples from various depths would be delivered to MECA for characterization of aqueous geochemistry and physical properties of soil grains, particularly size, shape, and hardness. These physical properties would be determined by optical and atomic force microscopy. When completed, detailed information of soil properties as a function of depth would be obtained. These various data sets would constrain our understanding of whether or not there are systematic variations in soil characteristics as a function of depth. These variations might be related, for example, to evaporative moisture losses and formation of salt deposits, thereby indicating water transport processes occurred fairly recently. Many other value-added measurement scenarios are being developed. For example, characterizing the nature and dynamics of dust deposition will be done using MIP/DART to provide deposition rates, Pancam and RAC imaging of lander and rover surfaces to extrapolate these measurements to other areas, and a variety of measurements to determine if the bulk loose soil has the same characteristics as dust that accumulates during the mission. Bedrock geology of the site is primarily an APEX-focus setting, mineralogy, and texture, and APXS data to be we interest will be to determine the extent to which rock hydrothermal processes, given that APEX is the precursor 4 and 2005 rover missions. Additional information is contained in the original.
Derived from text

Instrument Packages; Mineralogy; Mission Planning; Payloads; Physical Chemistry; Soil Science; Surveyor Project; Topography; Scheduling; Mars Surveyor 2001 Mission

20000025377 Search for Extraterrestrial Intelligence Inst., Moffett Field, CA USA

Computer Modeling of Electrostatic Aggregation of Granular Materials in Planetary and Astrophysical Settings

Marshall, J., Search for Extraterrestrial Intelligence Inst., USA; Sauke, T., Search for Extraterrestrial Intelligence Inst., USA; Studies of Mineralogical and Textural Properties of Martian Soil: An Exobiological Perspective; September 1999, pp. 56-58; In English; 30th; Lunar and Planetary Science, 15-19 Mar. 1999, Houston, TX, USA; See also 20000025351

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Electrostatic forces strongly influence the behavior of granular materials in both dispersed (cloud) systems and semi-packed systems. These forces can cause aggregation or dispersion of particles and are important in a variety of astrophysical and planetary settings. There are also many industrial and commercial settings where granular matter and electrostatics become partners for both good and bad. This partnership is important for human exploration on Mars where dust adheres to suits, machines, and habitats. Long-range Coulombic (electrostatic) forces, as opposed to contact-induced dipoles and van der Waals attractions, are generally regarded as resulting from net charge. We have proposed that in addition to net charge interactions, randomly distributed charge carriers on grains will result in a dipole moment regardless of any net charge. If grains are unconfined, or fluidized, they will rotate so that the dipole always induces attraction between grains. Aggregates are readily formed, and Coulombic polarity resulting from the dipole produces end-to-end stacking of grains to form filamentary aggregates. This has been demonstrated in USML experiments on Space Shuttle where microgravity facilitated the unmasking of static forces. It has also been demonstrated in a computer model using grains with charge carriers of both sign. Model results very closely resembled micro-g results with actual sand grains. Further computer modeling of the aggregation process has been conducted to improve our understanding of the aggregation process, and to provide a predictive tool for microgravity experiments slated for Space Station. These experiments will attempt to prove the dipole concept as outlined above. We have considerably enhanced the original computer model: refinements to the algorithm have improved the fidelity of grain behavior during grain contact, special attention has been paid to simulation time steps to enable establishment of a meaningful, quantitative time axis, and calibration of rounding accuracies have been conducted to test cumulative numerical influences in the model. The model has been run for larger grain populations, variable initial cloud densities, and we have introduced random net charging to individual grains, as well as a net charge to the cloud as a whole. The model uses 3 positive and 3 negative charges randomly distributed on each grain, with up to 160 grains contained within various size ”boxes” that define the initial number densities in the clouds. Each charge represents localized charged region on a grain, but does not necessarily imply single quantized charge carriers. The Coulomb equations are then allowed to interact for each monopole: dipoles and any higher order charge coupling is a natural product of these ”free” interactions over which the modeler exerts no influence. The charges are placed on surfaces of grains at random locations. A series of runs was conducted for neutral grains that had a perfect balance of negative and positive char carriers. Runs were also conducted with grains having additional fractional charges ranging between 0 and 1. by adding fractional charges of one sign, the model

created grain populations in which all grains had excess charges the same sign, giving the cloud an overall net charge. This simulates clouds subjected to ionizing radiation (e. protoplanetary debris disk around a protosun), or any other process of charge biasing in a grain population (e.g., volcanic plumes). In another run series, random fractional charges of either sign were added to the grains so th some grains had a slight net positive charge while others had a slight net negative charge. This simulates triboelectrically-charged grain populations in which acquisition of an electron by one surface is at the expense creating a hole elsewhere. This dual sign charging was applied in two ways: in one case the cloud remained neutral by ensuring that all grain excess charges added to zero; in the other case, the cloud was permitted slight net char by not imposing a charge-balance condition. Additional information is contained in the original.
Derived from text
Computerized Simulation; Dust; Electrostatics; Microgravity; Sands; Electrostatic Charge; Dipole Moments

20000025378 NASA Goddard Space Flight Center, Greenbelt, MD USA
"Dust Devils": Gardening Agents on the Surface of Mars, and Hidden Hazards to Human Exploration?
Marshall, J., Search for Extraterrestrial Intelligence Inst., USA; Smith, P., Arizona Univ., USA; White, B., California Univ., USA; Farrell, W., NASA Goddard Space Flight Center, USA; Studies of Mineralogical and Textural Properties of Martian Soil: An Exobiological Perspective; September 1999, pp. 59-60; In English; 30th; Lunar and Planetary Science, 15-19 Mar. 1999, Houston, TX, USA; See also 20000025351
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Dust devils are familiar sites in the and regions of the world: they can produce quite spectacular displays of dust lofting when the vortices scavenge very loose dust from a dry lake bed or from recently disturbed agricultural fields. If one were to arrive at the center of an arid region, take one photograph, or even a series of photographs over a period of several days, then return the images for laboratory analysis, it would be most likely concluded that the region was inactive from an aeolian perspective. No images of general dust movement were obtained, nor were any dust devils "caught on camera" owing to their ephemeral and unpredictable appearance, and the fact that there was deceptively little residue of their actions. If, however, a camera were to take a 360 degree continuous recording over a period of a year, and the film were then to be shown at high speed over a period a several minutes, the impression might be that of a region ravaged by air vorticity and dust movement. Extrapolate this over geological time, and it is possible to visualize dust devils as prime aeolian agents, rather than insignificant vagaries of nature, On Mars, the thin atmosphere permits the surface of the planet to be heated but it does not itself retain heat with the capacity of the earth's atmosphere. This gives rise to greater thermal instability near the surface of Mars as "warm" air pockets diapiritically inject themselves into higher atmospheric layers. Resulting boundary-layer vorticity on Mars might therefore be expected to produce dust devils in abundance, if only seasonally. The spectacular images of dust devils obtained by Pathfinder within its brief functional period on the planet testify to the probability of highly frequent surface vorticity in light of the above reasoning about observational probability. Notably, the Pathfinder devils appeared to be at least a kilometer in height. There are several consequences for the geology of Mars, and for human exploration, if dust devils are to be expected in reasonable abundance. First, from a geological perspective, the vortices will act as "gardening" agents for the top few centimeters of entrainable material. Over time (hundreds of millions, or billions of years being available), they will cover the surface with scouring paths, and the grain sizes that can be lofted by a vortex probably extends over the whole sand to dust range. The depositional paths are, of course, much larger, so that vortex-induced deposition is more widespread than vortex-induced erosion, and will without doubt, affect the whole region in which the dust devils occur (this might explain why rocks at the Viking site seemed oddly capped with dust in a region apparently subject to general aeolian scouring). On Mars, the lift forces in dust devils might be less than on earth owing to the much thinner atmosphere, but this may be counterbalanced by lower gravity and greater vortex velocities. Certainly, when active, other aeolian phenomena on Mars --sand motion and dust storms, seem no less energetic and no less capable of lofting sediments than equivalent terrestrial aeolian phenomena. Every several years, within the current climatic regime, the surface of Mars is subject to light dust fall from global dust storms. Over time, this should develop a very uniform surface layer, with commensurate uniformity in grain size, mineralogy, albedo, color, and general spectroscopic properties. Dust devils will disturb this situation by continually mixing the surface dust with underlying layers, perhaps composed of silt and sand. This size mixing will also involve compositional mixing. After some years, the thin layer of dust that may be difficult to entrain alone, becomes progressively mixed with coarser materials that could reduce the general aeolian threshold of the soil. Certainly the continual disturbance by vorticity will prevent surface stabilization that may bind or indurate grains (caused by slow cementation or ice welding at grain boundaries). If dust devils continually loft dust to kilometer heights, and the dust is sprayed into many cubic kilometers of atmosphere each time, could the devils produce a continual background of atmospheric dust that might be mistaken for the fallout of a distant large-scale dust storm? From a human exploration perspective, dust devils are unlikely to pose any, life- threatening situation for an astronaut unfortunate enough to encounter a momentary swirling cloud of loose soil. However, it is noted that pervasive dust is probably one of the greatest long-term hazards for a human encampment. The fineness and penetration

capabilities of the dust, its electrostatic adhesive properties, and its complete ubiquity, render the material a persistent nuisance at best, but at worst, over a period of many months it is possible that space suits, machinery, habitat interiors, air filters, and so forth, could become jeopardized. Owing to dust penetration, the space suits used in the Apollo landings were rendered unusable after a few EVA activities. There will be a definite attempt to situate a human colony on Mars in an area that is far removed from the regions of the planet known for being the centers of major dust storms. At the heart of these storm systems, the dust lofting mechanics are unknown, but they are energetic and perhaps potentially life-threatening for an astronaut. Locating a colony in a region that appears from space to be meteorologically benign may lead to colony placement in a region prone to dust devils, but dust devils are not (or have not been) detectable from orbital observations: the region surveyed for placement will appear like the apparently inactive and area referred to earlier. The region may be spared from highly energetic weather systems, but it may not be necessarily immune from continual dust disturbance. Additional information is contained in the original.
Derived from text
Dust; Dust Storms; Mars Surface; Planetary Geology; Wind Effects; Mars (Planet); Atmospheric Physics

20000025379 Search for Extraterrestrial Intelligence Inst., Moffett Field, CA USA
The Enigmatic Longevity of Granular Materials on Mars: The Case for Geologically Episodic Dune Formation
Marshall, J., Search for Extraterrestrial Intelligence Inst., USA; Studies of Mineralogical and Textural Properties of Martian Soil: An Exobiological Perspective; September 1999, pp. 61-62; In English; 30th; Lunar and Planetary Science, 15-19 Mar. 1999, Houston, TX, USA; See also 20000025351
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Martian sand dunes are concentrated in vast sand seas in the circumpolar belt of the planet's northern hemisphere, but they are also pervasive over the whole planet. Their occurrence is to be expected on a super-arid planetary surface subjected to boundary layer drag from a continually active atmosphere. Whilst their occurrence is to be expected, their survival is enigmatic. But the enigma only arises if the martian system is considered similar to Earth's --where sand is moved highly frequently, more or less on a seasonal basis. Experimentally it is readily demonstrated that active sand will soon wear down to small grains and eventually diminish to below the critical sand size required to sustain dune formation. According to conventional wisdom, sand moves at higher speeds on Mars than on Earth, and if it were to move as frequently as it does on Earth, then the dune-forming sand population should have long since disappeared, given the great longevity of the martian aeolian system (Sagan coined the term "kamikaze" grains to express this disappearance). No supply of sand could keep pace with this depletion, especially in light of the fact that Mars does not have very active weathering, nor significant crustal differentiation. On Earth, plate tectonics, magmatic activity, and general crustal differentiation over geological time have produced great concentrations of quartz crystals in the continental crustal masses. Not only are these quartz grains chemically and mechanically resilient, they are about the right size for being transported by either wind or water. Add to this, the geologically recent contribution of glacial grinding, and it is easy to see why there are dune field on Earth. So what are the martian dunes composed of, and how does the material survive the eons of attrition? In addition to experimental demonstrations of sand comminution in laboratory aeolian simulations, the problem can be approached from first principles. Sagan showed that by simple considerations of material strength versus mechanical work applied to the material, comminution to sub-sand size would be inevitable. Another semi-analytical approach might be taken by considering that the archetypal aeolian sand surface texture is an irregularly pitted ("frosted") surface composed of chipping hollows approximately 10 microns in diameter, 5 microns deep. Their volume = about 250 cubic microns, or about 1/25000 of the volume of a 100 micron diameter dune grain. Because a saltating grain always strikes another grain, then two surfaces are impacted. Thus each grain undergoes two impacts for every one saltation leap, when the impact statistics are considered for a closed dune system (it can be calculated that a grain can never undergo is less than 1 impact, and never is greater than 2 per saltation leap). Hence, if we conservatively assume that there is damage to a grain each time it bounces, but with the minimum damage of only 2 microscopic craters per impact, then approximately 12,500 impacts are required to completely eliminate the grain. of course, it would require only a fraction of this amount to reduce the grain to below sand size. A grain will make only several tens of saltation leaps on the stoss side of a dune before becoming buried on the lee slope. The dune then has to move its full length before the grain is exhumed again for abrasion. Even with this hiatus in transport, it is easy to see that terrestrial dunes need resupplying with sand in order to survive. In recent theoretical work it has been shown that martian aeolian transport may be initiated with high-speed grains, but this converts to a lower energy dynamic transport equilibrium in which a reptation population dominates grain transport (on Earth, at least half of the flux is by reptation and creep). On Mars, therefore, average grain speeds may be lower than those on Earth, or at least comparable. This would permit greater longevity for martian sands, but it would not go far enough to solve the survival problem. It may, however, explain why martian dunes are about the same size as terrestrial dunes. If martian saltation leaps were significantly longer than on Earth (as usually assumed), then a dune's lee slope would have

to be correspondingly longer in order to trap the sand; this would scale up the whole dune structure. But with shorter trajectories in a reptation population, larger dunes would be unnecessary. Additional information is contained in the original.
Derived from text
Abrasion; Dunes; Dust Storms; Grain Size; Granular Materials; Mars (Planet); Mars Surface; Sands; Sediment Transport; Wind Effects

20000025380 Search for Extraterrestrial Intelligence Inst., Moffett Field, CA USA
Computer Modeling of Sand Transport on Mars Using a Compart-Mentalized Fluids Algorithm (CFA)
Marshall, J., Search for Extraterrestrial Intelligence Inst., USA; Stratton, D., Search for Extraterrestrial Intelligence Inst., USA; Studies of Mineralogical and Textural Properties of Martian Soil: An Exobiological Perspective; September 1999, pp. 63-65; In English; 30th; Lunar and Planetary Science, 15-19 Mar. 1999, Houston, TX, USA; See also 20000025351
Contract(s)/Grant(s): NCC2-926; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

It has been postulated that aeolian transport on Mars may be significantly different from that on Earth. From laboratory experiments simulating martian grain transport [2], it has been observed that (saltating) grains striking the bed can cause hundreds of secondary reptation trajectories when impact occurs at speeds postulated for Mars. Some of the ballistically induced trajectories ”die ouf’ and effectively join the ranks on the creep population that is merely nudged along by impact. Many of the induced reptation trajectories, however, are sufficiently high for the grains to become part of the saltation load (it is irrelevant to the boundary layer how a grain attained its initial lift force). When these grains, in turn, strike the surface, they too are capable of inducing more reptating grains. This cascading effect has been discussed in connection with terrestrial aeolian transport in an attempt to dispel the notion that sand motion is divisible only into creep and saltation loads. On Earth, only a few grains are splashed by impact. On Mars, it may be hundreds. We developed a computer model to address this phenomenon because there are some important ramifications: First, this ratio may mean that martian aeolian transport is dominated by reptation flux rather than saltation. On Earth, the flux would be a roughly balanced mixture between reptation/creep and saltation. On Venus, there would be no transport other than by saltation. In other words, an understanding of planetary aeolian processes may not be necessarily understood by extrapolating from the ”Earth case”, with only gravity and atmospheric density/viscosity being considered as variables. Second, the reptation flux on Mars may be self sustaining, so that little input is required by the wind once transport has been initiated. The number of grains saturating the boundary layer near the bed may mean that average grain speed on Mars might conceivably be less than that on Earth. This would say much for models of sand comminution on Mars. A multiple-grain transport model using just the equations of grain motion describing lift and drag is impossible to develop owing to stochastic effects --the very effects we wish to model. Also, unless we were to employ supercomputing techniques and extremely complex computer codes that could deal with millions of grains simultaneously, it would also be difficult to model grain transport if we attempted to consider every grain in motion. No existing computer models were found that satisfactorily used the equations of motion to arrive at transport flux numbers for the different populations of saltation and reptation. Modeling all the grains in a transport system was an intractable problem within our resources, and thus we developed what we believe to be a new modeling approach to simulating grain transport. The CFA deals with grain populations, but considers them to belong to various compartmentalized fluid units in the boundary layer. In this way, the model circumvents the multigrain problem by dealing primarily with the consequences of grain transport --momentum transfer between air and grains, which is the physical essence of a dynamic grain-fluid mixture. We thus chose to model the aeolian transport process as a superposition of fluids. These fluids include the air as well as particle populations of various properties. The prime property distinguishing these fluids is upward and downward grain motion. In a normal saltation trajectory, a grain’s downwind velocity increases with time, so a rising grain will have a smaller downwind velocity than a failing grain. Because of this disparity in rising and falling grain proper-ties, it seemed appropriate to track these as two separate grain populations within the same physical space. The air itself can be considered a separate fluid superimposed within and interacting with the various grain-cloud ”fluids”. Additional informaiton is contained in the original.
Derived from text
Computerized Simulation; Mars (Planet); Mars Surface; Sediment Transport; Wind (Meteorology); Wind Effects; Sands

20000025381 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
The MECA Payload as a Dust Analysis Laboratory on the MSP 2001 Lander
Marshall, J., Search for Extraterrestrial Intelligence Inst., USA; Anderson, M., Jet Propulsion Lab., California Inst. of Tech., USA; Buehler, M., Jet Propulsion Lab., California Inst. of Tech., USA; Frant, M., Orion Research, Inc., USA; Fuerstenau, S., Orion Research, Inc., USA; Hecht, M., Orion Research, Inc., USA; Keller, U., Max-Planck-Inst. fuer Aeronomie, Germany; Markiewicz, W., Max-Planck-Inst. fuer Aeronomie, Germany; Meloy, T., West Virginia Univ., USA; Pike, T., Jet Propulsion Lab., California Inst. of Tech., USA; Studies of Mineralogical and Textural Properties of Martian Soil: An Exobiological Perspective;

September 1999, pp. 66-67; In English; 30th; Lunar and Planetary Science, 15-19 Mar. 1999, Houston, TX, USA; See also 20000025351
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In a companion abstract, the ”Mars Environmental Compatibility Assessment” (MECA) payload for Mars Surveyor Program 2001 (MSP 2001) is described in terms of its capabilities for addressing exobiology on Mars. Here we describe how the same payload elements perform in terms of gathering data about surface dust on the planet. An understanding of the origin and properties of dust is important to both human exploration and planetary geology. The MECA instrument is specifically designed for soil/dust investigations: it is a multifunctional laboratory equipped to assess particulate properties with wet chemistry, camera imagery, optical microscopy (potentially with LTV fluorescence capability), atomic force microscopy (AFM; potentially with mineral-discrimination capabilities), electrometry, active & passive external materials-test panels, mineral hardness testing, and electrostatic & magnetic materials testing. Additionally, evaluation of soil chemical and physical properties as a function of depth down to about 50 cm will be facilitated by the Lander/MECA robot arm on which the camera (RAC) and electrometer are mounted. Types of data being sought for the dust include: (1) general textural and grain-size characterization of the soil as a whole --for example, is the soil essentially dust with other components or is it a clast-supported material in which dust resides only in the clast interstices, (2) size frequency distribution for dust particles in the range 0.01 to 10.00 microns, (3) particle-shape distribution of the soil components and of the fine dust fraction in particular, (4) soil fabric such as grain clustering into clods, aggregates, and cemented/indurated grain amalgamations, as well as related porosity, cohesiveness, and other mechanical soil properties, (5) cohesive relationship that dust has to certain types of rocks and minerals as a clue to which soil materials may be prime hosts for dust ”piggybacking”, (6) particle, aggregate, and bulk soil electrostatic properties, (7) particle hardness, (8) particle magnetic properties, (9) bulk dust geochemistry (solubility, reactivity, ionic and mineral species). All of these quantities are needed in order for the human exploration program to make assessments of hazards on Mars, and to better enable the production on earth, of soil/dust simulants that can act as realistic test materials in terms of those properties that render dust a contaminant.Such properties include the small grain size that enables penetration of space-suit joints, mechanical interfaces and bearings, seals, etc., and presents difficulty for filtration systems. Size also plays a critical role in the potential for lung disease in long-term habitats. The properties of grain shape and hardness are important parameters in determining the abrasiveness of dust as it enters mechanical systems, or bombards helmet visors and habitat windows in dust-laden winds. Adhesive electrostatic and magnetic properties of dust will be prime causes of contamination of space suits and equipment. Contamination causes mechanical malfunction, tracking of dirt into habitats, ”piggybacking” of toxins on dust into habitats, changes in albedo and efficiency of solar arrays and heat exchangers, and changes in electrical conductivity of suit surfaces and other materials that may have specific safety requirements regarding electrical conductivity. Other potentially hazardous properties of dust include the possibility of high solubility of some component grains (rendering them reactive), and toxicity of some materials --grains of superoxidants and heavy metals (there is always the slim, but not inconceivable possibility of biogenic components such as spores). Because Mars has no active surface aqueous regime, volcanic emissions, meteoritic debris, weathering products, and photochemical products of Mars have nowhere to go except reside in the surface; there are few mechanical or chemical (buffering) processes to remove the accumulation of eons. From a planetology perspective, there are many enigmatic issues relating to dust and the aeolian regime in general. MECA will be able to address many questions in this area. For example, if MECA determines a particular particle size distribution (size and sorting values), it will be possible to make inferences about the origin of the dust - - is it all aeolian, or a more primitive residue of weathering, volcanic emissions, and meteoritic gardening? Trenching with the Lander/MECA robot arm will enable local stratigraphy to be determined in terms of depositional rates, amounts and cyclicity in dust storms and/or local aeolian transport. Grain shape will betray the origin of the dust fragments as being the product of recent or ancient weathering, or the comminution products of aeolian transport --the dust-silt ratio might be a measure of aeolian comminution energy. Additional information is contained in the original.
Derived from text

Dust; Electrostatics; Exobiology; Payloads; Soils; Mars Surveyor 2001 Mission; Electrometers; Cameras; Mission Planning

20000025382 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

The MECA Payload as an Exobiology Laboratory on the MSP 2001 Lander

Marshall, J., Search for Extraterrestrial Intelligence Inst., USA; Anderson, M., Jet Propulsion Lab., California Inst. of Tech., USA; Buehler, M., Jet Propulsion Lab., California Inst. of Tech., USA; Frant, M., Orion Research, Inc., USA; Fuerstenau, S., Orion Research, Inc., USA; Hecht, M., Orion Research, Inc., USA; Keller, U., Max-Planck-Inst. fuer Aeronomie, Germany; Markiewicz, W., Max-Planck-Inst. fuer Aeronomie, Germany; Meloy, T., West Virginia Univ., USA; Pike, T., Jet Propulsion Lab., California Inst. of Tech., USA; Studies of Mineralogical and Textural Properties of Martian Soil: An Exobiological Perspective; September 1999, pp. 68-70; In English; Lunar and Planetary Science, 15-19 Mar. 1999, Houston, TX, USA; See also 20000025351

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The ”Mars Environmental Compatibility Assessment” (MECA) payload for Mars Surveyor Project 2001 (MSP 2001) is comprised of a multifunctional laboratory equipped to assess martian soil properties with wet chemistry, camera imagery, optical microscopy (potentially with UV fluorescence capability), atomic force microscopy (AFM; potentially with mineral-discrimination capabilities), electrometry, active & passive external materials-test panels, mineral hardness testing, and electrostatic and magnetic materials testing. Additionally, evaluation of soil chemical and physical properties as a function of depth down to -50 cm will be facilitated by the Lander/MECA robot arm on which the camera (RAC) and electrometer are mounted. MECA was designed as a NASA Human Exploration and Development of Space (HEDS) payload for determining the properties of martian soil that may be detrimental to human exploration. It is, however, well equipped to address exobiology questions in the following areas: (1)Geochemical clues to Aqueous Mineralogy and Oxidant formation; (2) Soil structures and microfabrics as indicators of water-volatiles migration; (3) Minerals and rocks as clues to ancient hydrology; (4) Grain textures as indicators of aqueous activity and weathering. Additional information is contained in the original.

Author

Exobiology; Mars Surface; Mars Surveyor 2001 Mission; Payloads; Soil Science; Water; Mars (Planet); Mars Environment

20000025383 Lunar and Planetary Inst., Houston, TX USA

Characterization of Regolith Volatile Transport and Storage Properties by The MECA MSP 2001 Lander Payload

Clifford, S. M., Lunar and Planetary Inst., USA; Marshall, J., Search for Extraterrestrial Intelligence Inst., USA; Studies of Mineralogical and Textural Properties of Martian Soil: An Exobiological Perspective; September 1999, pp. 71-73; In English; 30th; Lunar and Planetary Science, 15-19 Mar. 1999, Houston, TX, USA; See also 20000025351

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The diffusive and adsorptive properties of the Martian regolith influence the exchange of volatiles between the atmosphere and subsurface. Our quantitative knowledge of these properties is extremely poor -introducing substantial uncertainties in efforts to model long-term evolution of ground ice and diurnal, seasonal, and climatic cycles of CO2 and H20. This situation should significantly improve upon arrival of the 2001 Mars Surveyor Lander in 2002. In support of the Human Exploration and Development of Space (HEDS) enterprise, the 2001 mission will include a suite of instruments to characterize the nature of the Martian environment and assess whether it contains hazards that may threaten future human exploration. A major element of this effort is the Mars Environmental Compatibility Assessment (MECA) payload, which consists an optical microscopy system incorporating electrostatic, magnetic, and scratch-hardness materials testing palets, an atomic force microscope with imaging capabilities comparable to an SEM, a wet chemistry laboratory with four independent test cells, an electrometer on the robotic arm, material test patches, a camera also mounted on the arm, and a soil scoop for excavating down to about 50 cm into the soil. Although conceived to address the needs of HEDS, MECA payload is a sophisticated soil science laboratory that should provide a wealth of new data relevant to the volatile transport and storage properties of the regolith. Additional information os contained in the original.

Author

Adsorptivity; Electrostatics; Mars Environment; Mars Surface; Planetary Geology; Regolith; Transport Properties; Diffusivity; Mars Surveyor 2001 Mission; Mars (Planet)

20000025384 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

”EGM” (Electrostatics of Granular Matter): A Space Station Experiment to Examine Natural Particulate Systems

Marshall, J., Search for Extraterrestrial Intelligence Inst., USA; Sauke, T., Search for Extraterrestrial Intelligence Inst., USA; Buehler, M., Jet Propulsion Lab., California Inst. of Tech., USA; Farrell, W., NASA Goddard Space Flight Center, USA; Green, R., NASA Lewis Research Center, USA; Birchenough, A., NASA Lewis Research Center, USA; Studies of Mineralogical and Textural Properties of Martian Soil: An Exobiological Perspective; September 1999, pp. 74-75; In English; 30th; Lunar and Planetary Science, 15-19 Mar. 1999, Houston, TX, USA; See also 20000025351

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A granular-materials experiment is being developed for a 2002 launch for Space Station deployment. The experiment is funded by NASA HQ and managed through NASA Lewis Research Center. The experiment will examine electrostatic aggregation of coarse granular materials with the goals of (a) obtaining proof for an electrostatic dipole model of grain interactions, and (b) obtaining knowledge about the way aggregation affects the behavior of natural particulate masses: (1) in unconfined dispersions (clouds such as nebulae, aeolian dust palls, volcanic plumes), (2) in semi-confined, self-loaded masses as in fluidized flows (pyroclastic surges, avalanches) and compacted regolith, or (3) in semi-confined non-loaded masses as in dust layers

adhering to solar cells or space suits on Mars. The experiment addresses both planetary/astrophysical issues as well as practical concerns for human exploration of Mars or other solar system bodies. Additional information is contained in the original.
Derived from text
Dust; Electrostatics; Granular Materials; Particulates; Spaceborne Experiments; Adhesion; Cohesion; Dipole Moments; Particles

20000025385 NASA Goddard Space Flight Center, Greenbelt, MD USA
Radio Frequencies Emitted by Mobile Granular Materials: A Basis for Remote Sensing of Sand and Dust Activity on Mars and Earth
Marshall, J., Search for Extraterrestrial Intelligence Inst., USA; Farrell, W., NASA Goddard Space Flight Center, USA; Houser, G., NASA Goddard Space Flight Center, USA; Bratton, C., Search for Extraterrestrial Intelligence Inst., USA; Studies of Mineralogical and Textural Properties of Martian Soil: An Exobiological Perspective; September 1999, pp. 76-78; In English; 30th; Lunar and Planetary Science, 15-19 Mar. 1999, Houston, TX, USA; See also 20000025351
Contract(s)/Grant(s): NCC2-926; No Copyright; Abstract Only; Avail. from CASI as part of the entire parent document

In recent laboratory experiments, measurements were made of microsecond radio-wave (RF) bursts emitted by grains of sand as they energetically circulated in a closed, electrically ungrounded chamber. The bursts appeared to result from nanoscale electrical discharging from grain surfaces. Both the magnitude and wave form of the RF pulses varied with the type of material undergoing motion. The release of RF from electrical discharging is a well-known phenomenon, but it is generally measured on much larger energy scales (e.g., in association with lightning or electrical motors). This phenomenon might be used to detect, on planetary surfaces, the motion and composition of sand moving over dunes, the turbulent motion of fine particles in dust storms, highly-energetic grain and rock collisions in volcanic eruptions, and frictional grinding of granular materials in dry debris flows, landslides, and avalanches. The occurrence of these discharges has been predicted from theoretical considerations Additional information is contained in the original.
Derived from text
Dust; Granular Materials; Radio Frequencies; Radio Waves; Remote Sensing; Sands; Dust Storms

20000025386 NASA Johnson Space Center, Houston, TX USA
Interaction of Space Suits with Windblown Soil: Preliminary Mars Wind Tunnel Results
Marshall, J., Search for Extraterrestrial Intelligence Inst., USA; Bratton, C., Search for Extraterrestrial Intelligence Inst., USA; Kosmo, J., NASA Johnson Space Center, USA; Trevino, R., NASA Johnson Space Center, USA; Studies of Mineralogical and Textural Properties of Martian Soil: An Exobiological Perspective; September 1999, pp. 79-80; In English; 30th; Lunar and Planetary Science, 15-19 Mar. 1999, Houston, TX, USA; See also 20000025351
Contract(s)/Grant(s): NCC2-926; No Copyright; Abstract Only; Avail. from CASI as part of the entire parent document

Experiments in the Mars Wind Tunnel at NASA Ames Research Center show that under Mars conditions, spacesuit materials are highly susceptible to dust contamination when exposed to windblown soil. This effect was suspected from knowledge of the interaction of electrostatically adhesive dust with solid surfaces in general. However, it is important to evaluate the respective roles of materials, meteorological and radiation effects, and the character of the soil. The tunnel permits evaluation of dust contamination and sand abrasion of space suits by simulating both pressure and wind conditions on Mars. The long-term function of space suits on Mars will be primarily threatened by dust contamination. Lunar EVA activities caused heavy contamination of space suits, but the problem was never seriously manifest because of the brief utilization of the suits, and the suits were never reused. Electrostatically adhering dust grains have various detrimental effects: (1) penetration and subsequent wear of suit fabrics, (2) viewing obscuration through visors and scratching/pitting of visor surfaces, (3) penetration, wear, and subsequent seizing-up of mechanical suit joints, (4) changes in albedo and therefore of radiation properties of external heat-exchanger systems, (5) changes in electrical conductivity of suit surfaces which may affect tribocharging of suits and create spurious discharge effects detrimental to suit electronics/radio systems. Additional information is contained in the original.
Derived from text
Mars Atmosphere; Simulation; Space Suits; Visors; Wind Tunnels; Mars (Planet); Dust; Dust Storms; Sands

20000027385 Colorado School of Mines, Div. of Economics and Business, Golden, CO USA
Economics of Lunar Mineral Exploration
Blair, Brad R., Colorado School of Mines, USA; Space Resources Utilization Roundtable; 1999, pp. 1; In English; See also 20000027384; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Exploration of space is increasingly being rationalized by the potential for long-term commercial payoffs. The commercial use of lunar resources is gaining relevance as technology and infrastructure increase, and will depend on an adequate foundation

of geological information. While past lunar exploration has provided detailed knowledge about the composition, geologic history and structural characteristics of the lunar surface at six locations, the rest of the Moon remains largely unexplored. The purpose of this paper is to describe traditional methods and decision criteria used in the mineral exploration business. Rationale for terrestrial mineral exploration is firmly entrenched within the context of economic gain, with asset valuation forming the primary feedback to decision making. The paper presents a summary of relevant knowledge from the field of exploration economics, applying it to the case of space mineral development. It includes a description of the current paradigm of both space exploration and terrestrial mineral exploration, as each pertains to setting priorities and decision making. It briefly examines issues related to space resource demand, extraction and transportation to establish its relevance.
Author
Mineral Exploration; Lunar Exploration; Economics; Commerce

20000027389 Orbital Technologies Corp., Madison, WI USA
Lunar Polar Ice: Methods for Mining the New Resource for Exploration
Gustafson, Robert J., Orbital Technologies Corp., USA; Rice, Eric E., Orbital Technologies Corp., USA; Space Resources Utilization Roundtable; 1999, pp. 9-10; In English; See also 20000027384; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The presence of ice in permanently shadowed depressions near the lunar poles and determination of its properties will significantly influence both the near- and long-term prospects for lunar exploration and development. Since data from the Lunar Prospector spacecraft indicate that water ice is likely present (the instrument measures hydrogen strongly suggests the presence of water), it is important to understand how to extract it for beneficial use, as well as how to preserve it for scientific analysis. Two types of processes can be considered for the extraction of water ice from the lunar poles. In the first case, energy is transported into the shadowed regions, ice is constrain models of impacts on the lunar surface and processed in-situ, and water is transported out of the cold trap. In the second case, ice-containing regolith can be mined in the cold trap, transported outside the cold trap, and the ice extracted in a location with abundant solar energy. A series of conceptual implementations has been examined and criteria have been developed for the selection of systems and subsystems for further study.
Author
Lunar Surface; Lunar Exploration; Ice; Moon; Lunar Mining

20000027393 Academy of Sciences (USSR), Mining Inst. of Kola Science Centre, Apatity, USSR
Role of Mining in Space Development
Melnikov, N. N., Academy of Sciences (USSR), USSR; Nagovitsyn, O. V., Academy of Sciences (USSR), USSR; Space Resources Utilization Roundtable; 1999, pp. 17-18; In English; See also 20000027384; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Human expansion in Space is inconceivable without the creation of a comfortable habitat. The occupation of Space bodies can be similar to colonization of uninhabited regions of the Earth, but it will be significantly different. On the Earth, humans can use products from living things, in Space mineral resources are the only resource. This fact predetermines a crucial role of mining in Space.
Author
Extraterrestrial Resources; Mineral Deposits; Space Exploration; Mining

20000027394 Naval Research Lab., Washington, DC USA
A Commercial/Lunar Resources Exploration Concept
Nozette, S., Naval Research Lab., USA; Space Resources Utilization Roundtable; 1999, pp. 19; In English; See also 20000027384; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Lunar polar volatile deposits could have impact on future space system development. If these deposits are localized and can be exploited without complex, mass and energy intensive regolith moving and chemical processing, they might be economically utilized to support space activities in the next 10-30 years. Examination of potential system architectures, which use lunar polar volatilize, can provide requirements for future robotic lunar exploration required to further characterize these deposits. Trends in the Geosynchronous Orbit (GEO) communications satellite industry suggest synergies between lunar development and commercial and military uses of space. About 120-200 GEO spacecraft are deployed every 10 years. Since the energy required to reach GEO and lunar orbit are equivalent operations in one domain can impact the other. This has already been successfully demonstrated by Hughes Space and Communications (HSC) use of a lunar gravity assist (LGA) to rescue a previously useless communications satellite. Trends in GEO technology and broadband markets suggest high power (50-100 kW) systems and large apertures could be in demand for a variety of commercial and military application within 10-20 years. In addition various space

control, missile defense, and reconnaissance system concepts envisioned for deployment in this period will be mass and area intensive. These could have synergies with lunar exploration and development.
Derived from text
Lunar Exploration; Lunar Resources; Geosynchronous Orbits; Communication Satellites; Mineral Deposits

20000027399 NASA Johnson Space Center, Houston, TX USA
An Overview of NASA's current In-Situ Consumable Production (ISCP) Development Activities and Goals
Sanders, G. B., NASA Johnson Space Center, USA; Space Resources Utilization Roundtable; 1999, pp. 31-32; In English; See also 20000027384; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Utilization of extraterrestrial resources, or In-Situ Resource Utilization (ISRU), is viewed as an enabling technology for the exploration and commercial exploitation of our solar system. It is fundamental to any program of extended human presence and operation on other extraterrestrial bodies that we learn how to utilize the indigenous resources. The chief benefits of ISRU are that it can reduce the mass, cost, and risk of robotic and human exploration while providing capabilities that the enable commercial development of space. A key subset of ISRU which has significant cost and risk reduction benefits for robotic and human exploration, and which requires a minimum of infrastructure, is In-Situ Consumable Production (ISCP). ISCP involves acquiring, manufacturing, and storing propellants for planetary ascent or Earth return vehicles, gases and water for crew and life support, and fuel cell reagents for power generation by using resources available at the site of exploration. Since propellant mass typically makes up 60 to 80% of the ascent or Earth return vehicle mass, In-Situ Propellant Production (ISPP) on the Lunar or Mars surface can significantly reduce the overall mass for the return vehicle needed to be brought from Earth. Systems analyses of human Mars missions have indicated that solely producing propellants on the surface of Mars by processing atmospheric carbon dioxide can reduce the initial mission mass required in low Earth orbit by approximately 20% as compared to carrying all required propellant to the Mars surface from Earth. An even greater leverage can occur for Mars missions when in-situ water can be processed.
Author
Extraterrestrial Resources; Solar System; Consumables (Spacecraft); Lunar Surface; Mars Surface

20000027400 Wisconsin Univ., Dept. of Nuclear Engineering and Engineering Physics, Madison, WI USA
Perspectives on Lunar Helium-3
Schmitt, Harrison H., Wisconsin Univ., USA; Space Resources Utilization Roundtable; 1999, pp. 33; In English; See also 20000027384; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Global demand for energy will likely increase by a factor of six or eight by the mid-point of the 21 st Century due to a combination of population increase, new energy intensive technologies, and aspirations for improved standards of living in the less-developed world. Lunar helium-3 (3He), with a resource base in the Tranquillitatis titanium-rich lunar maria of at least 10,000 tonnes, represents one potential energy source to meet this rapidly escalating demand. The energy equivalent value of 3He delivered to operating fusion power plants on Earth would be about $3 billion per tonne relative to today's coal which supplies most of the approximately $90 billion domestic electrical power market. These numbers illustrate the magnitude of the business opportunity. The results from the Lunar Prospector neutron spectrometer suggests that 3He also may be concentrated at the lunar poles along with solar wind hydrogen. Mining, extraction, processing, and transportation of helium to Earth requires new innovations in engineering but no known new engineering concepts. By-products of lunar 3He extraction, largely hydrogen, oxygen, and water, have large potential markets in space and ultimately will add to the economic attractiveness of this business opportunity. Inertial electrostatic confinement (IEC) fusion technology appears to be the most attractive and least capital intensive approach to terrestrial fusion power plants. Heavy lift launch costs comprise the largest cost uncertainty facing initial business planning, however, many factors, particularly long term production contracts, promise to lower these costs into the range of $1-2000 per kilogram versus about $70,000 per kilogram fully burdened for the Apollo Saturn V rocket. A private enterprise approach to developing lunar 3He and terrestrial IEC fusion power would be the most expeditious means of realizing this unique opportunity. In spite of the large, long-term potential return on investment, access to capital markets for a lunar 3He and terrestrial fusion power business will require a near-term return on investment, based on early applications of IEC fusion technology.
Author
Helium Isotopes; Lunar Maria; Energy Technology; Lunar Resources

20000027402 Texas Univ., Civil Engineering Dept., Austin, TX USA
Subsurface Exploration From Lander and Rover Platforms with Seismic Surface Waves
Stokoe, Kenneth H., II, Texas Univ., USA; Wright, Stephen G., Texas Univ., USA; Carrier, W. David, III, Lunar Geotechnical Inst., USA; Space Resources Utilization Roundtable; 1999, pp. 37-38; In English; See also 20000027384; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

To develop useful products in space environment, engineering evaluations of relevant geologic materials will have to be conducted early in the exploration phase. These evaluations will be required in the planning and design of constructed facilities and resource recovery operations. One emerging technology for such studies is based on the measurement and analysis of seismic surface waves of the Rayleigh (R) type. All measurements are performed in situ, are nondestructive, and require only instrumentation placed on the planetary surface being investigated. The product of each set of measurements is a profile of shear wave velocity versus depth at the test location. The profile can range from a one-dimensional to a three dimensional image, depending upon the number and configuration of the measurements. The depth of the profile is proportional to the length of the instrumentation array, with exploration depths of 5 cm to 15 m. targeted in this work. The resulting profiles can be used to evaluate or estimate the characteristics of the geologic materials in terms of: 1. layering and lateral continuity in the subsurface, 2. in situ densities and their spatial variations, 3. in situ strengths, 4. weathering processes (especially relative to exterior surfaces of rocks and boulders), 5. crater mechanics, 6. changes in the geologic materials with thermal changes, and 7. identifying ice and characterizing, its lateral extent, depth and general composition (massive versus nodules).
Derived from text
Seismic Waves; Aerospace Environments; Viking Lander Spacecraft; Roving Vehicles; Planetary Surfaces

20000027403 Tennessee Univ., Planetary Geosciences Inst., Knoxville, TN USA
Space Weathering and the Formation of Lunar Soil: The Moon as the Model for all Airless Bodies in the Solar System
Taylor, Lawrence A., Tennessee Univ., USA; Space Resources Utilization Roundtable; 1999, pp. 39-40; In English; See also 20000027384; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Detailed knowledge of the physical, chemical, and mineralogical characteristics of the lunar soil is requisite to understanding the complex processes that have formed this soil. The nature of the weathering processes on the Moon, although markedly different from those on Earth, are the same ones that occur on most relatively smaller, 'airless' bodies in the Solar System, such as asteroids (cf., Vesta, Eros) and moons such as Phobos and Deimos. Therefore, the effects of "space weathering" on the formation of lunar soils provides the ground-truth requisite to understanding regolith development on all airless bodies. Indeed, the immediate impetus for the renewed and intensified characterization of lunar soil is driven by the desire to refine remote sensing observations. With this new knowledge comes the fringe benefits that can be directed for efficient planning of practical utilization of lunar regolith at a Lunar Base.
Derived from text
Weathering; Solar System; Lunar Soil; Moon; Remote Sensing; Mineralogy

20000027407 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Approach to Mars Field Geology
Muehlberger, William, Texas Univ., USA; Rice, James W., Lunar and Planetary Inst., USA; Parker, Timothy, Jet Propulsion Lab., California Inst. of Tech., USA; Lipps, Jere H., California Univ., USA; Hoffman, Paul, Harvard Univ., USA; Burchfiel, Clark, Massachusetts Inst. of Tech., USA; Brasier, Martin, Oxford Univ., UK; Mars Field Geology, Biology. and Paleontology Workshop: Summary and Recommendations; [1998], pp. 5-13; In English; See also 20000027406; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The goals of field study on Mars are nothing less than to understand the processes and history of the planet at whatever level of detail is necessary. A manned mission gives us an unprecedented opportunity to use the immense power of the human mind to comprehend Mars in extraordinary detail. to take advantage of this opportunity, it is important to examine how we should approach the field study of Mars. In this effort, we are guided by over 200 years of field exploration experience on Earth as well as six manned missions exploring the Moon.
Author
Mars Surface; Planetary Geology; Mars (Planet); Manned Mars Missions; Mars Exploration; Mission Planning; Planetary Evolution

20000027408 NASA Johnson Space Center, Houston, TX USA
Instrumentation: Analytical Capabilities on Mars
Westall, Frances, NASA Johnson Space Center, USA; Allen, Carl, Lockheed Martin Corp., USA; Braiser, Martin, Oxford Univ., UK; Farmer, Jack, Arizona State Univ., USA; Massell, Wulf, Epic Geophysical Co., USA; Agee, Carl B., NASA Johnson Space Center, USA; Steele, Andrew; Fortson, Russ; Mars Field Geology, Biology. and Paleontology Workshop: Summary and Recommendations; [1998], pp. 15-24; In English; See also 20000027406; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Human exploration of Mars will consist of a series of long-term missions, with early missions focusing upon establishing the Mars base, and undertaking basic field reconnaissance. A capable laboratory on Mars is an essential element in the exploration strategy. Analytical equipment both in the field and in the laboratory serves to extend the senses of the crew and help them sharpen their sampling skills as they learn to recognize rocks in the field and understand their geologic context and significance. On-site sample analyses allow results to be incorporated into evolving surface exploration plans and strategies, which will be developing in real-time as we learn more about Mars. Early Mars missions will focus on reconnaissance EVAs to collect rock and soil samples, maximizing the amount of Mars material returned to Earth. Later missions will be increasingly devoted to both extensive field campaigns and laboratory analyses. The capabilities and equipment described below will be built up at the Mars base incrementally over many missions, with science payloads and investigative infrastructure being partitioned among launch opportunities. This discussion considers what we require to measure, observe, and explore on a new planetary territory. Alternatively, what do we need to know and how do we equip ourselves to provide ample capabilities to acquire these data? Suggestions follow describing specific instruments that we could use. Appendix 5 lists a strawman science instrument payload, and a feasibility study of equipment transportation into the field on pressurized or unpressurized rovers.
Derived from text
Mars Exploration; Manned Mars Missions; Mars Surface Samples; Measuring Instruments; Spacecraft Instruments; Mission Planning; Microscopes; Optical Measuring Instruments; Mars Surface; Mars (Planet); Mars Environment

20000027411 Science Applications International Corp., Houston, TX USA
Mars Surface Reference Mission, 1998 Excerpts, Appendix 1
Hoffman, Stephen, Science Applications International Corp., USA; Mars Field Geology, Biology. and Paleontology Workshop: Summary and Recommendations; [1998], Appendix 1, pp. 39-58; In English; See also 20000027406; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This presentation discusses the geological field work which will be the key objective to the Mars surface mission. Section one discusses one of the means by which the crew will get into the field, the use of the EVA in the vicinity of the outpost. Guidelines are given for the development of the EVA suit, and conduct of the EVA itself. The next section discusses the use of the unpressurized and pressurized rovers that will be used to transport the crew to sites which are too far to walk and that are of interest. The next section discusses the field camp which will be used for extended exploration of a site too distant to explore with the use of the rovers. The next section discusses mechanisms to evaluate the different toxic and biological hazards which the crew will possibly encounter in all phases of their mission. The methods for sample curation and storage is discussed next. The last section discusses some of the analytical capabilities that are likely to be used on the martian surface, including the possibility of handling biologically active samples.
CASI
Extravehicular Activity; Geology; Mars Surface; Roving Vehicles; Toxic Hazards; Manned Maneuvering Units; Astronaut Locomotion; Life Support Systems; Mars (Planet); Extravehicular Mobility Units; Mars Sample Return Missions

20000027412 Lunar and Planetary Inst., Houston, TX USA
Workshop Communications, Agenda, and Discussion Outlines, Appendix 3
Duke, Michael B., Lunar and Planetary Inst., USA; Mars Field Geology, Biology. and Paleontology Workshop: Summary and Recommendations; [1998], Appendix 3, pp. 67-73; In English; See also 20000027406; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This document consists of the letters of invitation to the conference participants, and the letter sent to those who will attend, including the agenda for the meeting. The purpose of the workshop is to explore the objectives, desired capabilities, and operational requirements for the first field exploration of Mars.
CASI
Mars (Planet); Manned Mars Missions; Mission Planning

20000027413 Lunar and Planetary Inst., Houston, TX USA
Strawman Science Payloads and Feasibility Study, Appendix 4
Mars Field Geology, Biology. and Paleontology Workshop: Summary and Recommendations; [1998], Appendix 4, pp. 75; In English; See also 20000027406; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This document lists and estimates the payload mass for suggested analytical payloads, and the rover payload.
Author
Payloads; Measuring Instruments; Recording Instruments; Weight (Mass); Roving Vehicles; Research Vehicles; Mission Planning

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SOLAR PHYSICS

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

20000025302 Maryland Univ., Dept. of Physics, College Park, MD USA
Data Reduction and Analysis from the SOHO Spacecraft ***Final Report, 1 Nov. 1996 - 31 Oct. 1999***
Ipavich, F. M., Maryland Univ., USA; [1999]; 32p; In English
Contract(s)/Grant(s): NAG5-2754; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents a final report on Data Reduction and Analysis from The SOHO Spacecraft from November 1, 1996-October 31, 1999. The topics include: 1) Instrumentation; 2) Health of Instrument; 3) Solar Wind Web Page; 3) Data Analysis; and 4) Science. This paper also includes appendices describing routine SOHO (Solar and Heliospheric Observatory) tasks, SOHO Science Procedures in the UMTOF (University Mass Determining Time-of-Flight) System, SOHO Programs on UMTOF and a list of publications.
CASI
Data Reduction; SOHO Mission; Time of Flight Spectrometers; Spacecraft Instruments

20000026852 NASA Goddard Space Flight Center, Greenbelt, MD USA
Energy-Dependent Ionization States of Shock-Accelerated Particles in the Solar Corona
Reames, Donald V., NASA Goddard Space Flight Center, USA; Ng, C. K., NASA Goddard Space Flight Center, USA; Tylka, A. J., Naval Research Lab., USA; [2000]; 8p; In English
Contract(s)/Grant(s): NASA Order S-92662-F; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We examine the range of possible energy dependence of the ionization states of ions that are shock-accelerated from the ambient plasma of the solar corona. If acceleration begins in a region of moderate density, sufficiently low in the corona, ions above about 0.1 MeV/amu approach an equilibrium charge state that depends primarily upon their speed and only weakly on the plasma temperature. We suggest that the large variations of the charge states with energy for ions such as Si and Fe observed in the 1997 November 6 event are consistent with stripping in moderately dense coronal. plasma during shock acceleration. In the large solar-particle events studied previously, acceleration occurs sufficiently high in the corona that even Fe ions up to 600 MeV/amu are not stripped of electrons.
Author
Charged Particles; Ionization; Ions; Solar Corona; Solar Flares; Space Plasmas; Solar Wind

20000027498 Southwest Research Inst., Instrumentation and Space Research Div., San Antonio, TX USA
Ly(alpha) Photolysis in the Primitive Solar Nebula ***Final Report, 1 Apr. 1997 - 31 Aug. 1998***
Gladstone, G. Randall, Southwest Research Inst., USA; [1998]; 9p; In English
Contract(s)/Grant(s): NAG5-4290; NAGw-4290; SwRI Proj. 15-8939; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This is the final report for the third year of work on this project. Our proposal was to quantitatively investigate the importance of photochemistry in the solar nebula. In the generally accepted theory for the chemical evolution of the primitive solar nebula, Prinn and Fegley argued that photochemistry is unimportant, and that thermochemistry controls the relative abundances of molecular species throughout the planet-forming region. They provided useful estimates of the chemical energy available to the solar nebula from a variety of sources, and established that even the small photolysis rate due to starlight is more important than the photolysis rate from direct sunlight (although small, the UV flux from starlight could have processed a non-negligible fraction of the solar nebula. The reason for this is that the opacity of the disk was so large that direct sunlight could only penetrate to 0.1 AU or so, despite the expectation that the protosun, if comparable to a T-Tauri star, would be emitting up to 10(exp 4) more H I Ly(alpha) photons than the current sun. We developed a Monte Carlo resonance fine radiative transfer code, capable of accurately calculating the radiation field of H I Ly(alpha), He I 584 A, and He II 304 A emissions throughout the nebula and the nearby interstellar medium in which it is embedded. We applied the code to two appropriate models of the primitive solar nebula. Our model provided the photolysis rates of various species over the entire surface layer of the nebula, and from this we evaluated the importance of UV photochemistry due to backscattered solar UV resonance line emissions on different parts of the nebula. The results discussed below were presented.
Derived from text
Photolysis; Solar Spectra; Quantitative Analysis; Photochemical Reactions; Interstellar Matter; Planetary Nebulae; Lyman Alpha Radiation

20000027500 Science Applications International Corp., San Diego, CA USA
Heating and Large Scale Dynamics of the Solar Corona ***Final Report, 25 Sep. 1995 - 24 Sep. 1999***
Schnack, Dalton D., Science Applications International Corp., USA; Feb. 08, 2000; 34p; In English
Contract(s)/Grant(s): NASw-5018; PR-01-0157-04-4865-000
Report No.(s): CNP0031B; SAIC: 00/8000;APPAT-226; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The effort was concentrated in the areas: coronal heating mechanism, unstructured adaptive grid algorithms, numerical modeling of magnetic reconnection in the MRX experiment: effect of toroidal magnetic field and finite pressure, effect of OHMIC heating and vertical magnetic field, effect of dynamic MESH adaption.
CASI
Heating; Solar Corona; Dynamic Characteristics; Temperature Effects; Pressure Effects; Mathematical Models

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SPACE RADIATION

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

20000025438 NASA Marshall Space Flight Center, Huntsville, AL USA
Origin of Gamma-Ray Emissions from the MeV Blazars
Ghosh, K. K., National Research Council; Ramsey, B. D., NASA Marshall Space Flight Center, USA; [1998]; 1p; In English; 3rd; International Gamma-Ray Astrophysics Lab. Workshop (INTEGRAL), 14-18 Sep. 1998, Sicily, Italy; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

More than sixty gamma-ray emitting blazars have been detected by the Compton Gamma Ray Observatory (CGRO). A sub-class of these blazars is known as MeV blazars that are most luminous at the MeV energies. Spectra of these sources show a break somewhere between 1 MeV and 30 MeV with break amplitude as large as Delta(Gamma) = 1.5. Different models like Compton cooling jet models, synchrotron self-Compton models, etc., have been suggested to explain the observed properties of the MeV luminous blazars. However these models are unable to account for spectral break amplitudes in excess of 0.5. Here we suggest an inverse-Compton model based on recent published experimental data where MeV gamma rays were produced via Compton backscattering of UV photons with 500 MeV electrons. We show that the high energy electrons of the relativistic jet can collide with the copious ultraviolet photons of the big blue bump of the blazar, and produce photons peaked in the MeV region. Also we show that the X rays and the soft gamma rays in these sources are produced through the synchrotron self-Compton process. Flux computed from our model have been used to compare with the observed X-ray/ gamma-ray spectra of the MeV luminous blazars. Details of the model are discussed in the present paper.
Author
Gamma Ray Spectra; Blazars; Synchrotrons; Photons; High Energy Electrons

20000026338 NASA Goddard Space Flight Center, Greenbelt, MD USA
Detecting the Attenuation of Blazar Gamma-ray Emission by Extragalactic Background Light with GLAST
Chen, Andrew, NASA Goddard Space Flight Center, USA; Ritz, Steven, NASA Goddard Space Flight Center, USA; EGRET Team Papers to be Published in the Proceedings of the Fifth Compton Symposium; [1999]; 5p; In English; 5th, 15-17 Sep. 1999, Portsmouth, NH, USA; See also 20000026337; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Gamma rays with energy above 10 GeV interact with optical-UV photons resulting in pair production. Therefore, a large sample of high redshift sources of these gamma rays can be used to probe the extragalactic background starlight (EBL) by examining the redshift dependence of the attenuation of the flux above 10 GeV. GLAST, the next generation high-energy gamma-ray telescope, will for the first time have the unique capability to detect thousands of gamma-ray blazars up to redshifts of at least z = 4, with enough angular resolution to allow identification of a large fraction of their optical counterparts. by combining recent determinations of the gamma-ray blazar luminosity function, recent calculations of the high energy gamma-ray opacity due to EBL absorption, and the expected GLAST instrument performance to produce simulated samples of blazars that GLAST would detect, including their redshifts and fluxes, we demonstrate that these blazars have the potential to be a highly effective probe of the EBL.
Author
Detection; Attenuation; Blazars; Radio Sources (Astronomy); Light (Visible Radiation)

20000026339 NASA Goddard Space Flight Center, Greenbelt, MD USA
GeV Outbursts in Mrk 501
Sreekumar, P., Indian Space Research Organization, India; Bertsch, D. L., NASA Goddard Space Flight Center, USA; Bloom,

S. D., Hampden-Sydney Coll., USA; Hartman, R. C., NASA Goddard Space Flight Center, USA; Lin, Y. C., Stanford Univ., USA; Mukherjee, R., Barnard Coll., USA; Thompson, D. J., NASA Goddard Space Flight Center, USA; EGRET Team Papers to be Published in the Proceedings of the Fifth Compton Symposium; [1999]; 5p; In English; 5th, 15-17 Sep. 1999, Portsmouth, NH, USA; See also 20000026337; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Mrk 501 is the third TeV blazar with a known GeV component. Previous multiwavelength campaigns on Mrk 501 showed well correlated outbursts at x-ray and TeV energies with no significant activity at GeV energies. We present here new evidence suggesting GeV outbursts in Mrk 501 when the spectrum appears to be extremely hard. However, this outburst appears uncorrelated with emission at x-ray energies. The resulting spectral energy distribution suggests a sharp cut off in the high-energy emission beyond a few hundred GeV.

Author

Blazars; Radio Sources (Astronomy); Gamma Ray Bursts; X Ray Astronomy

20000026340 NASA Goddard Space Flight Center, Greenbelt, MD USA

Spectral Modeling of the EGRET 3EG Gamma Ray Sources Near the Galactic Plane

Bertsch, D. L., NASA Goddard Space Flight Center, USA; Hartman, R. C., NASA Goddard Space Flight Center, USA; Hunter, S. D., NASA Goddard Space Flight Center, USA; Thompson, D. J., NASA Goddard Space Flight Center, USA; Lin, Y. C., Stanford Univ., USA; Kniffen, D. A., NASA, USA; Kanbach, G., Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; Mayer–Hasselwander, H. A., Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; Reimer, O., Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; Sreekumar, P., Indian Space Research Organization, India; EGRET Team Papers to be Published in the Proceedings of the Fifth Compton Symposium; [1999]; 5p; In English; 5th, 15-17 Sep. 1999, Portsmouth, NH, USA; See also 20000026337; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The third EGRET catalog lists 84 sources within 10 deg of the Galactic Plane. Five of these are well-known spin-powered pulsars, 2 and possibly 3 others are blazars, and the remaining 74 are classified as unidentified, although 6 of these are likely to be artifacts of nearby strong sources. Several of the remaining 68 unidentified sources have been noted as having positional agreement with supernovae remnants and OB associations. Others may be radio-quiet pulsars like Geminga, and still others may belong to a totally new class of sources. The question of the energy spectral distributions of these sources is an important clue to their identification. In this paper, the spectra of the sources within 10 deg of Galactic Plane are fit with three different functional forms; a single power law, two power laws, and a power law with an exponential cutoff. Where possible, the best fit is selected with statistical tests. Twelve, and possibly an additional 5 sources, are found to have spectra that are fit by a breaking power law or by the power law with exponential cutoff function.

Author

Gamma Ray Observatory; Gamma Ray Telescopes; Gamma Rays; Gamma Ray Sources (Astronomy); Gamma Ray Astronomy; Radio Sources (Astronomy); Blazars; Pulsars

20000026341 Barnard Coll., Dept. of Physics and Astronomy, New York, NY USA

X-ray and Gamma-ray Observations of the COS-B Field 2CG 075+00

Mukherjee, R., Barnard Coll., USA; Gotthelf, E., Columbia Univ., USA; Stern, D., Barnard Coll., USA; Tavani, M., Columbia Univ., USA; EGRET Team Papers to be Published in the Proceedings of the Fifth Compton Symposium; [1999]; 5p; In English; 5th, 15-17 Sep. 1999, Portsmouth, NH, USA; See also 20000026337

Contract(s)/Grant(s): NAG5-7935; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We present a summary of gamma-ray and X-ray observations of the intriguing COS-B field, 2CG 075+00, in order to search for potential counterparts. The third EGRET (Energetic Gamma Ray Experiment Telescope) (3EG) catalog shows that the COS-B emission corresponds to at least two localized gamma-ray sources, 3EG 2016+3657 and 3EG J2021+3716. We present analyses of archival X-ray fields which overlap error boxes of both the EGRET sources.

Author

Gamma Rays; X Rays; Emission Spectra; Gamma Ray Sources (Astronomy); Gamma Ray Astronomy; Radio Sources (Astronomy); X Ray Sources

20000026342 NASA Goddard Space Flight Center, Greenbelt, MD USA

Multiwavelength Studies of the Peculiar Gamma-ray Source 3EG J1835+5918

Reimer, O., Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; Brazier, K. T. S., Durham Univ., UK; Carraminana, A., Instituto Nacional de Astrofisica, Optica y Electronica, Mexico; Kanbach, G., Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; Nolan, P. L., Stanford Univ., USA; Thompson, D. J., NASA Goddard Space Flight Center, USA; EGRET Team Papers to be Published in the Proceedings of the Fifth Compton Symposium; [1999]; 5p; In English; 5th, 15-17 Sep. 1999, Portsmouth,

NH, USA; See also 20000026337; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The source 3EG J1835+5918 was discovered early in the CGRO (Compton Gamma Ray Observatory) mission by EGRET as a bright unidentified gamma-ray source outside the galactic plane. Especially remarkable, it has not been possible to identify this object with any known counterpart in any other wavelengths band since then. Analyzing our recent ROSAT HRI observation, for the first time we are able to suggest X-ray counterparts of 3EG J1835+5918. The discovered X-ray sources were subject of deep optical investigations in order to reveal their nature and conclude on the possibility of being counterparts for this peculiar gamma-ray source.

Author

Gamma Rays; X Ray Sources; X Rays; Gamma Ray Sources (Astronomy); Emission Spectra

20000026343 NASA Goddard Space Flight Center, Greenbelt, MD USA

EGRET/COMPTEL Observations of an Unusual, Steep-Spectrum Gamma-Ray Source

Thompson, D. J., NASA Goddard Space Flight Center, USA; Bertsch, D. L., NASA Goddard Space Flight Center, USA; Hartman, R. C., NASA Goddard Space Flight Center, USA; Collmar, W., Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; Johnson, W. N., Naval Research Lab., USA; EGRET Team Papers to be Published in the Proceedings of the Fifth Compton Symposium; [1999]; 5p; In English; 5th, 15-17 Sep. 1999, Portsmouth, NH, USA; See also 20000026337; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

During analysis of sources below the threshold of the third EGRET catalog, we have discovered a source, named GRO J1400-3956 based on the best position, with a remarkably steep spectrum. Archival analysis of COMPTEL data shows that the spectrum must have a strong turn-over in the energy range between COMPTEL and EGRET. The EGRET data show some evidence of time variability, suggesting an AGN, but the spectral change of slope is larger than that seen for most gamma-ray blazars. The sharp cutoff resembles the high-energy spectral breaks seen in some gamma-ray pulsars. There have as yet been no OSSE observations of this source.

Author

Gamma Ray Bursts; Gamma Ray Astronomy; Gamma Ray Sources (Astronomy); Blazars; Pulsars; Active Galactic Nuclei

20000026344 NASA Goddard Space Flight Center, Greenbelt, MD USA

Preliminary Results from a New Analysis Method for EGRET Data

Thompson, D. J., NASA Goddard Space Flight Center, USA; Bertsch, D. L., NASA Goddard Space Flight Center, USA; Hunter, S. D., NASA Goddard Space Flight Center, USA; Deines–Jones, P., NASA Goddard Space Flight Center, USA; Dingus, B. L., Utah Univ., USA; Kniffen, D. A., NASA, USA; Sreekumar, P., Indian Space Research Organization, India; EGRET Team Papers to be Published in the Proceedings of the Fifth Compton Symposium; [1999]; 5p; In English; 5th, 15-17 Sep. 1999, Portsmouth, NH, USA; See also 20000026337; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In order to extend the life of EGRET, the gas in the spark chamber was allowed to deteriorate more than was originally planned for the nominal two year Compton Observatory mission. Gamma ray events are lost because the pattern recognition analysis rules are not optimized for the poorer quality data. By changing the rules used by the data analysts, we can recover a significant fraction of the lost events, allowing improved statistics for detection and study of sources. Preliminary results from the Crab, Geminga, and BL Lacertae indicate the feasibility of this analysis.

Author

Astronomical Catalogs; Tables (Data); Gamma Ray Observatory; Gamma Ray Telescopes; Crab Nebula; BL Lacertae Objects; Radio Sources (Astronomy); Gamma Ray Sources (Astronomy)

20000026345 NASA Goddard Space Flight Center, Greenbelt, MD USA

A Systematic Search for Short-term Variability of EGRET Sources

Wallace, P. M., Berry Coll., USA; Bertsch, D. L., NASA Goddard Space Flight Center, USA; Bloom, S. D., Jet Propulsion Lab., California Inst. of Tech., USA; Griffis, N. J., Berry Coll., USA; Hunter, S. D., NASA Goddard Space Flight Center, USA; Kniffen, D. A., NASA, USA; Thompson, D. J., NASA Goddard Space Flight Center, USA; EGRET Team Papers to be Published in the Proceedings of the Fifth Compton Symposium; [1999]; 5p; In English; 5th, 15-17 Sep. 1999, Portsmouth, NH, USA; See also 20000026337; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The 3rd EGRET Catalog contains 170 unidentified high-energy (E>100 MeV) gamma-ray sources, and there is great interest in the nature of these sources. One means of determining sources class is the study of flux variability on time scales of days; pulsars are believed to be stable on these scales while blazars are known to be highly variable. In addition, previous work has led to the discovery of 2CG 135+01 and GRO J1838-04, candidates for a new high-energy gamma-ray source class. These sources display transient behavior but cannot be associated with any known blazars. These considerations have led us to conduct a systematic search for short-term variability in EGRET data, covering all viewing periods through cycle 4. Three unidentified sources show some

evidence of variability on short time scales; the source displaying the most convincing variability, 3EG J2006-2321, is not easily identified as a blazar.
Author
Variability; Gamma Ray Observatory; Gamma Ray Telescopes; Astronomical Catalogs; Tables (Data); Gamma Ray Sources (Astronomy)

20000026346 NASA Goddard Space Flight Center, Greenbelt, MD USA
Some Aspects of the Radio Emission of EGRET-Detected Blazars
Lin, Y. C., Stanford Univ., USA; Bertsch, D. L., NASA Goddard Space Flight Center, USA; Bloom, S. D., Hampden-Sydney Coll., USA; Esposito, J. A., NASA Goddard Space Flight Center, USA; Hartman, R. C., NASA Goddard Space Flight Center, USA; Hunter, S. D., NASA Goddard Space Flight Center, USA; Kniffen, D. A., Hampden-Sydney Coll., USA; Kanbach, G., Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; Mayer–Hasselwander, H. A., Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; Michelson, P. F., Stanford Univ., USA; EGRET Team Papers to be Published in the Proceedings of the Fifth Compton Symposium; [1999]; 5p; In English; 5th, 15-17 Sep. 1999, Portsmouth, NH, USA; See also 20000026337; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

It has long been recognized that the high-latitude Energetic Gamma Ray Experiment Telescope (EGRET) sources can be identified with blazars of significant radio emission. Many aspects of the relation between high-energy gamma-ray emission and radio emission of EGRET-detected blazars remain uncertain. In this paper, we use the results of the recently published Third EGRET Source Catalog to examine in more detail to what extent the EGRET flux and the radio flux are correlated. In particular we examine the correlation (or the lack of it) in flux level, spectral shape, temporal variation, and detection limit. Many significant previous studies in these areas are also evaluated.
Author
Radio Emission; Gamma Ray Observatory; Gamma Ray Telescopes; Blazars; Gamma Ray Astronomy

20000026855 NASA Goddard Space Flight Center, Greenbelt, MD USA
High-Energy Spectral Signatures in Gamma-Ray Bursts
Baring, Matthew G., NASA Goddard Space Flight Center, USA; [2000]; 8p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

One of the principal results obtained by the EGRET experiment aboard the Compton Gamma-Ray Observatory (CGRO) was the detection of several gamma-ray bursts (GRBs) above 100 MeV. The broad-band spectra obtained for these bursts gave no indication of any high energy spectral attenuation that might preclude detection of bursts by ground-based Cerenkov telescopes (ACTs), thus motivating several TeV observational programs. This paper explores the expectations for the spectral properties in the TeV and sub-TeV bands for bursts, in particular how attenuation of photons by pair creation internal to the source modifies the spectrum to produce distinctive spectral signatures. The energy of spectral breaks and the associated spectral indices provide valuable information that can constrain the bulk Lorentz factor of the GRB outflow at a given time. These characteristics define palpable observational goals for ACT programs, and strongly impact the observability of bursts in the TeV band.
Author
Photons; Gamma Ray Bursts; Stellar Radiation; Gamma Ray Astronomy; Gamma Ray Sources (Astronomy)

20000026860 NASA Goddard Space Flight Center, Greenbelt, MD USA
High-Energy Spectral Signatures in Gamma-Ray Bursts
Baring, Matthew D., NASA Goddard Space Flight Center, USA; [1999]; 5p; In English; Snowbird TeV Gamma-Ray Workshop, 1999, New York, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

One of the principal results obtained by the EGRET experiment aboard the Compton Gamma-Ray Observatory (CGRO) was the detection of several gamma-ray bursts (GRBs) above 100 MeV. The broad-band spectra obtained for these bursts gave no indication of any high-energy spectral attenuation that might preclude detection of bursts by ground-based Cerenkov telescopes (ACTs), thus motivating several TeV observational programs. This paper explores the expectations for the spectral properties in the TeV and sub-TeV bands for bursts, in particular how attenuation of photons by pair creation internal to the source modifies the spectrum to produce distinctive spectral signatures. The energy of spectral breaks and the associated spectral indices provide valuable information that can constrain the bulk Lorentz factor of the GRB outflow at a given time. These characteristics define palpable observational goals for ACT programs, and strongly impact the observability of bursts in the TeV band.
Author
Spectral Signatures; Gamma Rays; Photons; Broadband; Cerenkov Radiation

20000027516 NASA Marshall Space Flight Center, Huntsville, AL USA

Optical Variability of BL Lacertae During the Major Outburst of 1997

Ghosh, K. K., NASA Marshall Space Flight Center, USA; Ramsey, B. D., NASA Marshall Space Flight Center, USA; Sadun, A. C., Colorado Univ., USA; Soundarajaperumal, S., Indian Inst. of Astrophysics, India; Wang, J., Academia Sinica, China; [1999]; 2p; In English; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

We have undertaken an investigation of recent flux variability in BL Lac. We present optical observations taken over 12 nights documenting major as well as minor outbursts. This has been combined, for purposes of multifrequency analysis, with published X-ray and gamma ray data taken for an additional single night. On two nights in particular, which includes the night of the X-ray observations, a major outburst of about a full magnitude of variation was recorded. All the data have been analyzed with theoretical models. Attempts were made to use synchrotron self-Compton and external Comptonization models to explain the data; however both classes of models were found lacking. More satisfactory results were obtained using an analytical model proposed by Wang et al. that involves the evolution of synchrotron spectra in a homogeneous jet due to the injection of relativistic electrons, taking into account radiation losses during the outbursts. It is hoped that the results of this study of BL Lac, an archetype for the class of blazars in general, represent a more generic phenomenon applicable to the entire class.

Author

Compton Effect; Visual Observation; BL Lacertae Objects; Radiant Flux Density; Luminous Intensity

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GENERAL

Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs such as Apollo, Gemini, and Mercury spacecraft, Earth Resources Technology Satellite (ERTS), and Skylab; NASA appropriations hearings.

20000026861 Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine, France

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The highlights of the last meeting of the Advisory Group for Aerospace Research and Development (AGARD), prior to the reorganization into the Research and Technology Organization (RTO), are presented. The highlights include the address by the Secretary General of NATO, Dr. Javier Soana, at the end of which he officially dissolves AGARD, the address by the Chief of Staff of the French Armed Forces, Jean-Phillipe Douin, and an address by the Chairman of the Military Committee of NATO, Klaus Naumann. A study which aimed to assess the impact of emerging technologies in the future of Aerospace, and military technology was summarized. Also remarks about the history of AGARD were given.

CASI

Military Technology; North Atlantic Treaty Organization (NATO); International Cooperation

20000027506 NASA, Washington, DC USA

”Before This Decade Is Out...”: Personal Reflections on the Apollo Program

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This handbook presents ”Before This Decade Is Out...” Personal Reflections on the Appolo Program. The accounts included in this book are a small sampling of the large number of oral histories that have been conducted under the auspices of the NASA history program, since near the beginning of the Agency. They also represent the many personal contributions made during Project Apollo, the single largest peacetime endeavor in American history. These recollections span the origins, management, and completion of that enormous effort and measurably enhance our appreciation of its difficulty. The comments of some of the key individuals involved in Project Apollo are being preserved by NASA and made available through this book. The people who are quoted in this book were among the top leaders of NASA. All of them played a prominent part in the conduct and accomplishments of Appolo.

Derived from text

Handbooks; Apollo Project; Histories; NASA Space Programs

Subject Term Index

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