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Langley Research Center

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

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

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Subject Divisions

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

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F. Life Sciences
G. Mathematical and Computer Sciences
H. Physics
I. Social and Information Sciences
J. Space Sciences
K. General

Indexes

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

Subject Term Index
Personal Author Index

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Subject Categories of the Division A. Aeronautics

Select a category to view the collection of records cited.

01 Aeronautics (General) 1

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

02 Aerodynamics 2

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 17

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 19

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 22

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 24

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*.

09 Research and Support Facilities (Air) 27

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) 28

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

15 Launch Vehicles and Launch Operations 31

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 32

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 36

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 37

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 39

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.

23 Chemistry and Materials (General) 40

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 41

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

25 Inorganic, Organic, and Physical Chemistry 44

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 60

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

27 Nonmetallic Materials 62

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 66

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 73

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

Subject Categories of the Division D. Engineering

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31 Engineering (General) 73

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

32 Communications and Radar 77

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 85

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 95

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 109

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 115

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 116

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

38 Quality Assurance and Reliability 119

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

39 Structural Mechanics 122

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

Subject Categories of the Division E. Geosciences

Select a category to view the collection of records cited.

42 Geosciences (General) 123

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

43 Earth Resources and Remote Sensing 124

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

44 Energy Production and Conversion 125

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

45 Environment Pollution 127

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

46 Geophysics 134

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 199

Includes weather observation forecasting and modification.

48 Oceanography 200

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.

51 Life Sciences (General) 200

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 235

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*.

54 Man/System Technology and Life Support 237

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*..

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59 Mathematical and Computer Sciences (General) 241

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 241

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 242

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 249

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 251

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 255

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

66 Systems Analysis and Operations Research 257

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

67 Theoretical Mathematics 258

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.

71 Acoustics 261

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 265

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

73 Nuclear Physics 266

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

74 Optics 266

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

75 Plasma Physics 271

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

76 Solid-State Physics 275

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

Subject Categories of the Division I. Social and Information Sciences

Select a category to view the collection of records cited.

81 Administration and Management 276

Includes management planning and research.

82 Documentation and Information Science 278

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

84 Law, Political Science and Space Policy 280

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

Subject Categories of the Division J. Space Sciences

Select a category to view the collection of records cited.

89 Astronomy 283

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

90 Astrophysics 286

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

91 Lunar and Planetary Science and Exploration 292

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 299

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

93 Space Radiation 300

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

Subject Categories of the Division K. General

Select a category to view the collection of records cited.

99 General 302

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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20000031244 Technische Univ., Hermann-Fottinger Inst. fuer Stroemungsmechanik, Berlin, Germany

10th European Drag Reduction Working Meeting: Book of Abstracts

Mar. 24, 1997; 49p; In English; 10th; Drag Reduction, 19-21 Mar. 1997, Berlin, Germany; See also 20000031245 through 20000031269

Contract(s)/Grant(s): F61708-97-W-0088

Report No.(s): AD-A371292; EOARD-CSP-97-1031; No Copyright; Avail: Defense Technical Information Center (DTIC); Abstracts Only

The final proceedings for 10th European Drag Reduction Working Meeting 19 March 1997-27 March 1997 Flow Characteristics over and around Riblets, Effects of Polymer Additives to Drag Reduction, Drag Reduction by Surfactants, Biological Aspects, Control of Transition, Turbulence and Separation, Longitudinal Vortices and Two-Phase Flows.

Author

Drag Reduction; Abstracts; Flow Characteristics; Riblets; Conferences

20000031533 Boeing Co., Seattle, WA USA

Configuration Aerodynamics ITD Team

Wilson, Douglas L., Boeing Co., USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 1, pp. 1-29; In English; See also 20000031532; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This paper presents viewgraphs to select the best analysis or design optimization methods for high speed aviation. The program goals are to demonstrate significant lift/drag maximum gains. The topics include: 1) Challenges (validation, viscous effects, multi-point conditions, and power effects); 2) Approaches (analytic methods and applications, design development, and test programs); and 3) Program (methods down select, viscous drag prediction, cruise point optimization, multi-point optimization and s&c cfd Predictions).

CASI

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20000027647 NASA Langley Research Center, Hampton, VA USA

1995 NASA High-Speed Research Program Sonic Boom Workshop, Volume 2, Configuration Design, Analysis, and Testing

Baize, Daniel G., Editor, NASA Langley Research Center, USA; 1995 NASA High-Speed Research Program Sonic Boom Workshop; December 1999; 188p; In English, 12-13 Sep. 1995, Hampton, VA, USA; See also 20000027648 through 20000027655

Contract(s)/Grant(s): RTOP 537-07-21-21

Report No.(s): NASA/CP-1999-209520/VOL2; NAS 1.55:209520/VOL2; L-17573/VOL2; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

The High-Speed Research Program and NASA Langley Research Center sponsored the NASA High-Speed Research Program Sonic Boom Workshop on September 12-13, 1995. The workshop was designed to bring together NASAs scientists and engineers and their counterparts in industry, other Government agencies, and academia working together in the sonic boom element of NASAs High-Speed Research Program. Specific objectives of this workshop were to: (1) report the progress and status of research in sonic boom propagation, acceptability, and design; (2) promote and disseminate this technology within the appropriate technical communities; (3) help promote synergy among the scientists working in the Program; and (4) identify technology pacing, the development C, of viable reduced-boom High-Speed Civil Transport concepts. The Workshop was organized in four sessions: Sessions 1 Sonic Boom Propagation (Theoretical); Session 2 Sonic Boom Propagation (Experimental); Session 3 Acceptability Studies-Human and Animal; and Session 4 - Configuration Design, Analysis, and Testing.

Author

High Speed; Conferences; Sonic Booms; Evaluation

20000027648 NASA Langley Research Center, Hampton, VA USA

A Whitham-Theory Sonic-Boom Analysis of the TU-144 Aircraft at a Mach Number of 2.2

Mack, Robert J., NASA Langley Research Center, USA; 1995 NASA High-Speed Research Program Sonic Boom Workshop; December 1999; Volume 2, pp. 1-16; In English; See also 20000027647; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

Officially, the TU-144 was the first supersonic-cruise, passenger-carrying aircraft to enter commercial service. Design, construction, and testing were carried out by the Soviet Union, flight certification was by the Soviet Union, and the only regular passenger flights were scheduled and flown across the territory of the Soviet Union. Although it was not introduced to international passenger service, there were many significant engineering accomplishments achieved in the design, production, and flight of this aircraft. Development of the aircraft began with a prototype stage. Systematic testing and redesign led to a production aircraft in discrete stages that measurably improved the performance of the aircraft from the starting concept to final aircraft certification. It flew in competition with the English-French Concorde for a short time, but was withdrawn from national commercial service due to a lack of interest by airlines outside the Soviet Union. NASA became interested in the TU- 144 aircraft when it was offered for use as a flying ”testbed” in the study of operating characteristics of a supersonic-cruise commercial airplane. Since it had been in supersonic-cruise service, the TU- 144 had operational characteris’tics similar to those anticipated in the conceptual aircraft designs being studied by the USA aircraft companies. In addition to the other operational tests being conducted on the TU-144 aircraft, it was proposed that two sets of sonic-boom pressure signature measurements be made. The first set would be made on the ground, using techniques and devices similar to those in reference I and many other subsequent studies. A second set would be made in the air with an instrumented aircraft flying close under the TU-144 in supersonic flight. Such in-flight measurements would require pressure gages that were capable of accurately recording the flow-field overpressures generated by the TU- 144 at relatively close distances under the vehicle. Therefore, an analysis of the TU-144 was made to obtain predictions of pressure signature shape and shock strengths at cruise conditions so that the range and characteristics of the required pressure gages could be determined well in advance of the tests. Cancellation of the sonic-boom signature measurement part of the tests removed the need for these pressure gages. Since CFD methods would be used to analyze the aerodynamic performance of the TU-144 and make similar pressure signature predictions, the relatively quick and simple Whitham-theory pressure signature predictions presented in this paper could be used for comparisons. Pressure signature predictions of sonic-boom disturbances from the TU-144 aircraft were obtained from geometry derived from a three-view description of the production aircraft. The geometry was used

to calculate aerodynamic performance characteristics at supersonic-cruise conditions. These characteristics and Whitham/Walkden sonic-boom theory were employed to obtain F-functions and flow-field pressure signature predictions at a Mach number of 2.2, at a cruise altitude of 61000 feet, and at a cruise weight of 350000 pounds.
Derived from text
Aerodynamic Characteristics; Commercial Aircraft; Computational Fluid Dynamics; Pressure Measurement; Supersonic Flight; Supersonic Speed; TU-144 Aircraft

20000027649 Lockheed Engineering and Sciences Co., Hampton, VA USA
Langley's Computational Efforts in Sonic-Boom Softening of the Boeing HSCT
Fouladi, Kamran, Lockheed Engineering and Sciences Co., USA; 1995 NASA High-Speed Research Program Sonic Boom Workshop; December 1999; Volume 2, pp. 47-72; In English; See also 20000027647
Contract(s)/Grant(s): NAS1-19000; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

NASA Langley's computational efforts in the sonic-boom softening of the Boeing high-speed civil transport are discussed in this paper. In these efforts, an optimization process using a higher order Euler method for analysis was employed to reduce the sonic boom of a baseline configuration through fuselage camber and wing dihedral modifications. Fuselage modifications did not provide any improvements, but the dihedral modifications were shown to be an important tool for the softening process. The study also included aerodynamic and sonic-boom analyses of the baseline and some of the proposed "softened" configurations. Comparisons of two Euler methodologies and two propagation programs for sonic-boom predictions are also discussed in the present paper.
Author
Sonic Booms; Computation; Supersonic Transports; Civil Aviation

20000027650 NASA Langley Research Center, Hampton, VA USA
Sonic Boom Minimization Efforts on Boeing HSCT Baseline
Cheung, Samson H., McDonnell-Douglas Aerospace, USA; Fouladi, Kamran, NASA Langley Research Center, USA; Haglund, George, Boeing Commercial Airplane Co., USA; Tu, Eugene, NASA Ames Research Center, USA; 1995 NASA High-Speed Research Program Sonic Boom Workshop; December 1999; Volume 2, pp. 73-94; In English; See also 20000027647; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

A team was formed to tackle the sonic boom softening issues of the current Boeing HSCT design. The team consisted of personnel from NASA Ames, NASA Langley, and Boeing company. The work described in this paper was done when the first author was at NASA Ames Research Center. This paper presents the sonic boom softening work on two Boeing High Speed Civil Transport (HSCT) baseline configurations, Reference-H and Boeing-1122. This presentation can be divided into two parts: parametric studies and sonic boom minimization by CFD optimization routines.
Author
Sonic Booms; Design Analysis; Softening; Parameterization; Supersonic Transports

20000027651 Boeing Commercial Airplane Co., Seattle, WA USA
Potential for Sonic Boom Reduction of the Boeing HSCT
Haglund, George T., Boeing Commercial Airplane Co., USA; 1995 NASA High-Speed Research Program Sonic Boom Workshop; December 1999; Volume 2, pp. 96-120; In English; See also 20000027647
Contract(s)/Grant(s): NAS1-20220; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

The HSR sonic boom technology program includes a goal of reducing the objectionable aspects of sonic boom. Earlier HSCT sonic boom studies considered achieving significant sonic boom reduction by the use of arrow-wing planforms and detailed shaping of the airplane to produce shaped waveforms (non N-waves) at the ground. While these design efforts were largely successful, the added risk and cost of the airplanes were judged to be unacceptable. The objective of the current work is to explore smaller configuration refinements that could lead to reduced sonic boom impact, within design and operational constraints. A somewhat modest target of 10% reduction in sonic boom maximum overpressure was selected to minimize the effect on the configuration performance. This work was a joint NASA/Industry effort, utilizing the respective strengths of team members at Boeing, NASA Langley, and NASA Ames. The approach used was to first explore a wide range of modifications and airplane characteristics for their effects on sonic boom and drag, using classical Modified Linear Theory (MLT) methods. CFD methods were then used to verify promising, modifications and to analyze modifications for which the MLT methods were not appropriate. The tea m produced a list of configuration changes with their effects on sonic boom and, in some cases, an estimate of the drag penalty. The most promising modifications were applied to produce a boom-softened derivative of the baseline Boeing High

Speed Civil Transport (HSCT) configuration. This boom-softened configuration was analyzed in detail for the reduce sonic boom impact and also for the effect of the configuration modifications on drag, weight, and overall performance relative to the baseline. Author

Sonic Booms; Supersonic Transports; Waveforms; Sound Transmission

20000027652 NASA Langley Research Center, Hampton, VA USA

Boom Softening and Nacelle Integration on an Arrow-Wing High-Speed Civil Transport Concept

Mack, Robert J., NASA Langley Research Center, USA; 1995 NASA High-Speed Research Program Sonic Boom Workshop; December 1999; Volume 2, pp. 121-136; In English; See also 20000027647; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

During the last cycle of concept design and wind-tunnel testing, the goal of the low-boom- shaped HSCT concepts (the B-935, the LB-16, and the LB- 1 8) was to meet mission requirements and generate shaped, ground-level pressure signatures with nose shock strengths of 1.0 psf or less. The wind-tunnel tests of these concepts produced results that were partially successful and encouraging although not fully up to expectations. In spite of this, however, these conceptual designs were overly optimistic and not acceptable because: the wing planforms had excessive area; the wing structural aspect ratio was too high; one concept had aft-fuselage rather than under-the-wing engines; and the gross takeoff weights were unrealistically low because of engines that were early, high-tech versions of later, revised, more-realistic engines. The need for reducing the ground-level overpressure shock strengths still existed; a need to be met within more restrictive guidelines of mission performance and gross takeoff weight limitations. Therefore, it was decided that the next conceptual design cycle would focus on decreased nose shock strengths, ”boom softening,” in the signatures of the Boeing and the McDonnell Douglas baseline concepts rather than low-boom concepts with shaped-signature designs. Overly-optimistic results were not the only problem with these low-sonic-boom concepts. Papers given at the 1994 Sonic-Boom Workshop had demonstrated that the problem of successful nacelle integration on HSCT concepts had only been partially solved. Wind-tunnel pressure signature data, from the HSCT-11B (a.k.a. the LB-18) wind-tunnel model, showed that the Langley HSCT design and analysis method had been successful in reducing the nacelle-volume disturbances in the flow field. This was due.to the engine nacelles mounted behind the wing trailing-edge on the aft fuselage so that no nacelle-wing interference-lift flow-field disturbances were generated. While acceptable from a sonic-boom research point of view, this concept was unacceptable from several practical and structural considerations. Preliminary wind-tunnel pressure signature data from the LB-16 wind-tunnel model, which had the engine nacelles mounted under the wings (the usual location), indicated that the application of the Langley nacelle-integration method had been only partially successful in the reduction of the nacelle-volume with nacelle-wing interference-lift pressure disturbances. So, ”boom softening” had to also address the task of successful integration of the engine nacelles, with the engines in the required under-the-wing location. Unless this problem was solved, low-sonic-boom and low-drag modifications to the wing planform, the airfoil shape, and the fuselage longitudinal area distribution could be nullified if the nacelle disturbances added increments to the nose-shock strengths that were removed through component tailoring. In this paper, an arrow-wing boom-softened HSC7 concept which incorporated modifications to a baseline McDonnell Douglas concept is discussed. The analysis of the concept’s characteristics will include estimates of weight, center of gravity, takeoff field length, mission range, and predictions of its ground-level sonic-boom pressure signature. Additional modifications which enhanced the softened-boom performance of this concept are also described as well as estimates of the performance penalties induced by these modifications.

Derived from text

Sonic Booms; Nacelles; Arrow Wings; High Speed; Supersonic Transports; Civil Aviation; Softening; Wind Tunnel Tests

20000027653 Northrop Grumman Corp., Advanced Technology and Development Center, Bethpage, NY USA

Sonic Boom Prediction and Minimization of the Douglas Reference OPT5 Configuration

Siclari, Michael J., Northrop Grumman Corp., USA; 1995 NASA High-Speed Research Program Sonic Boom Workshop; December 1999; Volume 2, pp. 138-160; In English; See also 20000027647; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

Conventional CFD methods and grids do not yield adequate resolution of the complex shock flow pattern generated by a real aircraft geometry. As a result, a unique grid topology and supersonic flow solver was developed at Northrop Grumman based on the characteristic behavior of supersonic wave patterns emanating from the aircraft. Using this approach, it was possible to compute flow fields with adequate resolution several body lengths below the aircraft. In this region, three-dimensional effects are diminished and conventional two-dimensional modified linear theory (MLT) can be applied to estimate ground pressure signatures or sonic booms. to accommodate real aircraft geometries and alleviate the burdensome grid generation task, an implicit marching multi-block, multi-grid finite-volume Euler code was developed as the basis for the sonic boom prediction methodology. The Thomas two-dimensional extrapolation method is built into the Euler code so that ground signatures can be obtained quickly

and efficiently with minimum computational effort suitable to the aircraft design environment. The loudness levels of these signatures can then be determined using a NASA generated noise code. Since the Euler code is a three-dimensional flow field solver, the complete circumferential region below the aircraft is computed. The extrapolation of all this field data from a cylinder of constant radius leads to the definition of the entire boom corridor occurring directly below and off to the side of the aircraft's flight path yielding an estimate for the entire noise "annoyance" corridor in miles as well as its magnitude. An automated multidisciplinary sonic boom design optimization software system was developed during the latter part of HSR Phase 1. Using this system, it was found that sonic boom signatures could be reduced through optimization of a variety of geometric aircraft parameters. This system uses a gradient based nonlinear optimizer as the driver in conjunction with a computationally efficient Euler CFD solver (NIIM3DSB) for computing the three-dimensional near-field characteristics of the aircraft. The intent of the design system is to identify and optimize geometric design variables that have a beneficial impact on the ground sonic boom. The system uses a simple wave drag data format to specify the aircraft geometry. The geometry is internally enhanced and analytic methods are used to generate marching grids suitable for the multi-block Euler solver. The Thomas extrapolation method is integrated into this system, and hence, the aircraft's centerline ground sonic boom signature is also automatically computed for a specified cruise altitude and yields the parameters necessary to evaluate the design function. The entire design system has been automated since the gradient based optimization software requires many flow analyses in order to obtain the required sensitivity derivatives for each design variable in order to converge on an optimal solution. Hence, once the problem is defined which includes defining the objective function and geometric and aerodynamic constraints, the system will automatically regenerate the perturbed geometry, the necessary grids, the Euler solution, and finally the ground sonic boom signature at the request of the optimizer.
Derived from text

Sonic Booms; Prediction Analysis Techniques; Aircraft Design; Computational Grids; Design Analysis; Multidisciplinary Design Optimization

20000027654 McDonnell-Douglas Aerospace, Long Beach, CA USA

Potential for Sonic Boom Reduction of the 2.4-H5085 Arrow Wing HSCT

Morgenstern, John M., McDonnell-Douglas Aerospace, USA; 1995 NASA High-Speed Research Program Sonic Boom Workshop; December 1999; Volume 2, pp. 162-174; In English; See also 20000027647; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

Preliminary human acceptability studies of sonic booms indicate that supersonic flight is unlikely to be acceptable even at noise levels significantly below 1994 low boom designs (reference 1, p. 288). Further, these low boom designs represent considerable changes to baseline configurations, and changes translate into additional effort and uncertain structural weight penalties that may provide no annoyance benefit, increasing the risk of including low boom technology. Since over land sonic boom designs were so risky (and yet the acceptability studies highlight how annoying sonic booms are), boom softening studies were undertaken to reduce the boom of baseline configurations using minor modifications that would not significantly change the designs. The goal of this work is to reduce boom levels over water. Even though Concorde over water boom has not been found to have any adverse environmental impact, boom levels for baseline HSCT designs are 50% higher in overpressure than the Concorde (due to a doubling in configuration weight with only a 50% increase in length),
Author

Sonic Booms; Supersonic Transports; Softening; Environmental Surveys; Civil Aviation; Acceptability

20000027655 Arizona State Univ., Dept. of Mechanical and Aerospace Engineering, Tempe, AZ USA

Development of a Multiobjective Optimization Procedure for Sonic Boom Minimization

Narayan, J. R., Arizona State Univ., USA; Chattopadhyay, A., Arizona State Univ., USA; Pagaldipti, N., Arizona State Univ., USA; 1995 NASA High-Speed Research Program Sonic Boom Workshop; December 1999; Volume 2, pp. 18-46; In English; See also 20000027647

Contract(s)/Grant(s): NCC2-5064; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

A design optimization procedure for improved sonic boom and aerodynamic performance of high speed aircraft is presented. The multiobjective optimization procedure simultaneously minimizes the sonic boom at a given distance from the aircraft and the drag-to-lift ratio (C(sub D)/C(sub L)) of the aircraft. Upper and lower bounds are also imposed on the lift coefficient. The Kreisselmeier - Steinhauser function is used for the multiobjective optimization formulation. A discrete semi-analytical aerodynamic sensitivity analysis procedure coupled with an analytical grid sensitivity analysis technique is used for evaluating design sensitivities. The use of the semi-analytical sensitivity analysis techniques results in significant computational savings. The flow equations are solved using a three-dimensional parabolized Navier-Stokes solver. Sonic boom analysis is performed using an extrapolation procedure. A nonlinear programming technique and an approximate analysis procedure are used for the optimization. The optimization procedure developed is applied to the design of two high speed configurations, namely, a doubly

swept wing-body configuration and a delta wing-body configuration. For the two sweep case only, minimization of the first peak in the pressure signature is performed first by optimizing only the nose radius and length of the aircraft. Minimization of the second peak in the pressure signature is performed next by optimizing only the wing geometric parameters. Significant improvements are obtained in the sonic boom characteristics and the aerodynamic performance of the wing-body configurations.
Author
Procedures; Optimization; Aerodynamic Characteristics; Sonic Booms; Design Analysis

20000027689 Academy of Sciences (USSR), Inst. of Hydrodynamics, Novosibirsk, USSR
The Preliminary Studies of Survivability of Nozzle Throat Materials in Ultrahigh Pressure of Nitrogen and Air ***Final Report***
Toptchiian, Marlen, Academy of Sciences (USSR), USSR; Nov. 1999; 19p; In English
Contract(s)/Grant(s): F61708-97-W-0138
Report No.(s): AD-A373115; EOARD-SPC-97-4044; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

One of the most complicated problems of the up-to-date experimental aerodynamics in simulation a hypersonic flight is the survival of a nozzle throat of a wind tunnel. An attempt to produce a flow ahead of a model, provided that the flow parameters are closely approximating natural those by general similarity criteria, leads to a rise of gas parameters in a settling chamber. In the modern operating facilities the pressure is up to 1 GPa 1, temperatures are from 2000 to 10000 K 2 for an operating time from a millisecond to several tenth fractions of a second.
DTIC
Hypersonic Flight; Composite Materials; Wind Tunnels; Nozzle Geometry; Flight Simulation

20000029549 NASA Langley Research Center, Hampton, VA USA
Theory and Experiment of Multielement Airfoils: A Comparison
Czerwiec, Ryan, North Carolina State Univ., USA; Edwards, J. R., North Carolina State Univ., USA; Rumsey, C. L., NASA Langley Research Center, USA; Hassan, H. A., North Carolina State Univ., USA; [2000]; 11p; 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): NAG1-1991
Report No.(s): AIAA Paper 2000-0985; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

A detailed comparison of computed and measured pressure distributions, velocity profiles, transition onset, and Reynolds shear stresses for multi-element airfoils is presented. It is shown that the transitional k-zeta model, which is implemented into CFL3D, does a good job of predicting pressure distributions, transition onset, and velocity profiles with the exception of velocities in the slat wake region. Considering the fact that the hot wire used was not fine enough to resolve Reynolds stresses in the boundary layer, comparisons of turbulence stresses varied from good to fair. It is suggested that the effects of unsteadiness be thoroughly evaluated before more complicated transition/turbulence models are used. Further, it is concluded that the present work presents a viable and economical method for calculating laminar/transitional/turbuient flows over complex shapes without user interface.
Author
Airfoils; Pressure Distribution; Velocity Distribution; Reynolds Stress; Boundary Layer Transition

20000029573 NASA Dryden Flight Research Center, Edwards, CA USA
In-Flight Wing Pressure Distributions for the NASA F/A-18A High Alpha Research Vehicle
Davis, Mark C., NASA Dryden Flight Research Center, USA; Saltzman, John A., NASA Dryden Flight Research Center, USA; March 2000; 66p; In English
Contract(s)/Grant(s): RTOP 529-55-24
Report No.(s): NASA/TP-2000-209018; NAS 1.60:209018; H-2389; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Pressure distributions on the wings of the F/A-18A High Alpha Research Vehicle (HARV) were obtained using both flush-mounted pressure orifices and surface-mounted pressure tubing. During quasi-stabilized 1-g flight, data were gathered at ranges for angle of attack from 5 deg to 70 deg, for angle of sideslip from -12 deg to +12 deg, and for Mach from 0.23 to 0.64, at various engine settings, and with and without the leading edge extension fence installed. Angle of attack strongly influenced the wing pressure distribution, as demonstrated by a distinct flow separation pattern that occurred between the range from 15 deg to 30 deg. Influence by the leading edge extension fence was evident on the inboard wing pressure distribution, but little influence was seen on the outboard portion of the wing. Angle-of-sideslip influence on wing pressure distribution was strongest at low angle

of attack. Influence of Mach number was observed in the regions of local supersonic flow, diminishing as angle of attack was increased. Engine throttle setting had little influence on the wing pressure distribution.
Author
Wings; Pressure Distribution; Wind Tunnel Tests

20000029610 NASA Langley Research Center, Hampton, VA USA
Sweep and Compressibility Effects on Active Separation Control at High Reynolds Numbers
Seifert, Avi, National Academy of Sciences - National Research Council, USA; Pack, LaTunia G., NASA Langley Research Center, USA; [2000]; 18p; 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 2000-0410; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper explores the effects of compressibility, sweep and excitation location on active separation control at high Reynolds numbers. The model, which was tested in a cryogenic pressurized wind tunnel, simulates the upper surface of a 20% thick GlauertGoldschmied type airfoil at zero angle of attack. The flow is fully turbulent since the tunnel sidewall boundary layer flows over the model. Without control, the flow separates at the highly convex area and a large turbulent separation bubble is formed. Periodic excitation is applied to gradually eliminate the separation bubble. Two alternative blowing slot locations as well as the effect of compressibility, sweep and steady suction or blowing were studied. During the test the Reynolds numbers ranged from 2 to 40 million and Mach numbers ranged from 0.2 to 0.7. Sweep angles were 0 and 30 deg. It was found that excitation must be introduced slightly upstream of the separation region regardless of the sweep angle at low Mach number. Introduction of excitation upstream of the shock wave is more effective than at its foot. Compressibility reduces the ability of steady mass transfer and periodic excitation to control the separation bubble but excitation has an effect on the integral parameters, which is similar to that observed in low Mach numbers. The conventional swept flow scaling is valid for fully and even partially attached flow, but different scaling is required for the separated 3D flow. The effectiveness of the active control is not reduced by sweep. Detailed flow field dynamics are described in the accompanying paper.
Author
Sweep Effect; Compressibility; Active Control; Excitation; Wind Tunnel Tests; Separated Flow

20000030677 NASA Langley Research Center, Hampton, VA USA
Low-Speed Investigation of Upper-Surface Leading-Edge Blowing on a High-Speed Civil Transport Configuration
Banks, Daniel W., NASA Langley Research Center, USA; Laflin, Brenda E. Gile, NASA Langley Research Center, USA; Kemmerly, Guy T., NASA Langley Research Center, USA; Campbell, Bryan A., NASA Langley Research Center, USA; December 1999; 62p; In English
Contract(s)/Grant(s): RTOP 537-03-22-02
Report No.(s): NASA/TP-1999-209538; NAS 1.60:209538; L-17483; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The paper identifies speed, agility, human interface, generation of sensitivity information, task decomposition, and data transmission (including storage) as important attributes for a computer environment to have in order to support engineering design effectively. It is argued that when examined in terms of these attributes the presently available environment can be shown to be inadequate. A radical improvement is needed, and it may be achieved by combining new methods that have recently emerged from multidisciplinary design optimisation (MDO) with massively parallel processing computer technology. The caveat is that, for successful use of that technology in engineering computing, new paradigms for computing will have to be developed - specifically, innovative algorithms that are intrinsically parallel so that their performance scales up linearly with the number of processors. It may be speculated that the idea of simulating a complex behaviour by interaction of a large number of very simple models may be an inspiration for the above algorithms; the cellular automata are an example. Because of the long lead time needed to develop and mature new paradigms, development should begin now, even though the widespread availability of massively parallel processing is still a few years away.
Author
Low Speed; High Speed; Civil Aviation; Leading Edges; Aerodynamic Configurations; Wind Tunnel Tests; Upper Surface Blowing

20000030691 Naval Surface Warfare Center, Dahlgren, VA USA

Review and Extension of Computational Methods for Noncircular Cross-Sectional Weapons

Moore, F. G., Naval Surface Warfare Center, USA; McInville, R. M., Naval Surface Warfare Center, USA; Hymer, T. C., Naval Surface Warfare Center, USA; Journal of Spacecraft and Rockets; Septmber-October 1998; Volume 35, No. 5, pp. 585-597; In English; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

A review of current state-of-the-art methods for computing aerodynamics of noncircular cross-sectional weapon concepts has been performed. In addition, an improved engineering method has been developed to compute aerodynamics of these nonaxisymmetric body configurations. The improved method is based on extending current state-of-the-art methods for computing aerodynamics of noncircular wing-body shapes based on circular wing-body methods. Specific additions to the state-of-the-art methods currently in use include extensions to a broader class of cross-sectional bodies and to a higher angle of attack; extensions to allow improved accuracy at low crossflow Mach number and to allow body cross-sectional shape to impact the critical crossflow Reynolds number; and a method to treat wing-body interference factor corrections as a function of body geometry, Mach number, and angle of attack. The new methods were applied to a broad class of noncircular body alone and wing-body configurations for which wind-tunnel data were available. In general, results for normal force, axial force, and center-of-pressure predictions were quite good for a semiempirical methodology, over the Mach number and angle-of-attack range where data were available. Range of variables included Mach numbers as low as 0.3 and as high as 14 and angles of attack to 60 deg.

Author

Cross Flow; Aerodynamic Configurations; Mathematical Models; Weapons; Cross Sections; Computation

20000031245 Technical Univ. of Tallinn, Tallinn, Estonia

The Natural Convection Heat Transfer Phenomana Near The Surface Covered by Riblets

Kaar, Harri, Technical Univ. of Tallinn, Estonia; Neshumajev, Dmitri, Technical Univ. of Tallinn, Estonia; 10th European Drag Reduction Working Meeting: Book of Abstracts; Mar. 24, 1997; 1p; In English; See also 20000031244; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Natural convection experiments were conducted in water, and mercury near the vertical cylindrical surface covered with riblet film (3M Corporation PVC film). The groove orientations were placed both parallel and perpendicular to the flow direction. V-grooves with depths of 75 micrometers were used. The experiments are performed in a range of complex (Gr x Pr (exp 2)) up to the 3 x 10 (exp 6) for mercury and in a range of Rayleigh numbers up to the Ra congruent to 1.6 x 10 (exp 11) for water. As known, the riblets may affect to the formation of vortices in the flow and are able to drag reduction in turbulent flow up to 10% at certain Re numbers. The dependence of heat transfer on riblets orientation in natural convection is not known exactly. Also for natural convection intensity affect the properties of surface material. Some results of measurements of temperature pulsations appeared with the turbulence in medium are shown. The fluctuations are recorded by fast data acquisition interface for PC and presented as the temperature difference between the surface of calorimeter and liquid.

Author

Convective Heat Transfer; Riblets; Surface Layers; Free Convection

20000031262 Technische Univ., FG Bionik and Evolutionstechnik, Berlin, Germany

Flexible Flaps for Separation Control on a Wing with Low Aspect Ratio

Patone, G., Technische Univ., Germany; Mueller, W., Technische Univ., Germany; 10th European Drag Reduction Working Meeting: Book of Abstracts; Mar. 24, 1997; 1p; In English; See also 20000031244; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

As part of a bionics project, an airfoil (NACA 2412) has been tested for its stall behaviour with flexible flaps attached to the upper surface. Analogous to the cover feathers on a bird’s wing, the flaps are able to prevent or at least delay the spreading of the eddy from the trailing towards the leading edge of the wing during stall. The experiments were conducted in an open circuit wind tunnel at Re=120 000, with the airfoil having an aspect ratio of 3.5. The NACA 2412 exhibits a sudden drop in generated lift when the angle of attack is increased beyond the critical value. With the appropriate flaps attached, this drop in lift production can be prevented or at least delayed, as the flaps will be lifted off the surface automatically when flow separation commences. It is important to note that the flaps remain smoothly on the surface of the airfoil as long as the angle of attack is below the critical value. Therefore, they have nearly no negative effect on the drag. Best results were obtained using materials of a certain porosity and flexibility. Because of the low aspect ratio of the airfoil used, the flow separation starts from the centre of the airfoil, and thus it is crucial that the flaps can form a pocket. So these flaps can serve as a smart safety device. In order to gain better insights into

the aerodynamic mechanism of the flaps, the pressure distribution over the surface of the airfoil was investigated. The results show the effect of the flaps to be a restriction of the separation, so that the remaining part of the airfoil can still generate lift.
Author
Low Aspect Ratio; Flaps (Control Surfaces); Flexibility; Separated Flow; Wind Tunnel Tests; Aerodynamics

20000031265 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Goettingen, Germany
Effects of Acoustic Excitation on Flow Separation from a Wing at High Angles of Incidence
Grosche, F.-R., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Kozlov, V. V., Academy of Sciences (USSR), USSR; 10th European Drag Reduction Working Meeting: Book of Abstracts; Mar. 24, 1997; 1p; In English; See also 20000031244; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

This paper concerns wind-tunnel experiments on the control of three-dimensional separation from a wing by external acoustic excitation. Flow visualization techniques were used to study the influence of sound waves on the flow separation from a wing of low aspect ratio 3:1 at Mach numbers M less than or equal to 0.1. Tests were made within the Reynolds number range 6 * 10 (exp 5) less than or equal to Re less than or equal to 1.2 * 10 (exp 6), at angles of incidence up to 25 degrees and yaw angles up to 30 degrees. Two different configurations of the acoustic excitation have been applied: 1. Spherical sound waves from a loudspeaker within the acoustic far field (Global excitation) and 2. Sound waves focused by an elliptical mirror on a small region of the wing (Localized excitation).
Author
Acoustic Excitation; Separated Flow; Wings; Wind Tunnel Tests; Angle of Attack

20000031269 Nottingham Univ., Dept. of Mechanical Engineering, UK
Heat-Transfer Characteristics of Drag-Reducing Riblets
Choi, Kwing-So, Nottingham Univ., UK; Orchard, David, Nottingham Univ., UK; 10th European Drag Reduction Working Meeting: Book of Abstracts; Mar. 24, 1997; 1p; In English; See also 20000031244; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The drag reduction capabilities of riblets were extensively researched in the past two decades with detailed results on the near-wall boundary layer structure over the passive device. The associated heat transfer characteristics of the micro-grooved surface were studied only by a handful of researchers, all of which, however, seem to show a large increase in heat-transfer efficiency. In order to study the structure of the thermal boundary layer over the riblet surface and understand the mechanisms responsible for this apparent breakdown of the Reynolds analogy, further investigations into the heat-transfer characteristics of riblets are necessary. In the present study we tried to make an accurate evaluation of the heat-transfer characteristics of slightly-heated riblet surfaces within and just outside its drag reduction regime (s (exp +) less than 60).
Author
Drag Reduction; Riblets; Conductive Heat Transfer

20000031365 NASA Langley Research Center, Hampton, VA USA
Piloted Simulation Study of a Dual Thrust-Cutback Procedure for Reducing High-Speed Civil Transport Takeoff Noise Levels
Riley, Donald R., NASA Langley Research Center, USA; Glaab, Louis J., Lockheed Engineering and Sciences Co., USA; Brandon, Jay M., NASA Langley Research Center, USA; Person, Lee H., Jr., NASA Langley Research Center, USA; Glaab, Patricia C., Unisys Corp., USA; December 1999; 72p; In English
Contract(s)/Grant(s): RTOP 537-03-22-08
Report No.(s): NASA/TP-1999-209698; L-17431; NAS 1.60:209698; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A piloted simulation study was performed for the purpose of indicating the noise reduction benefits and piloting performance that could occur for a typical 4-engine high-Speed Civil Transport (HSCT) configuration during takeoff when a dual thrust-cutback procedure was employed with throttle operation under direct computer control. Two thrust cutbacks were employed with the first cutback performed while the vehicle was accelerating on the run-way and the second cutback performed at a distance farther downrange. Added vehicle performance improvements included the incorporation of high-lift increments into the aerodynamic database of the vehicle and the use of limited engine oversizing. Four single-stream turbine bypass engines that had no noise suppression of any kind were used with this configuration. This approach permitted establishing the additional noise suppression level that was needed to meet Federal Air Regulation Part 36 Stage 3 noise levels for subsonic commercial jet aircraft.

Noise level results were calculated with the jet mixing and shock noise modules of the Aircraft Noise Prediction Program (ANOPP).
Author
Simulation; Takeoff; Aerodynamic Noise; Noise Reduction

20000031532 NASA Langley Research Center, Hampton, VA USA
1998 NASA High-Speed Research Program Aerodynamic Performance Workshop, Volume 1, Configuration Aerodynamics
McMillin, S. Naomi, Editor, NASA Langley Research Center, USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 1; 944p; In English, 9-13 Feb. 1998, Los Angeles, CA, USA; Sponsored by NASA Langley Research Center, USA; See also 20000031533 through 20000031552; Original contains color illustrations
Contract(s)/Grant(s): RTOP 537-07
Report No.(s): NASA/CP-1999-209692/VOL1/PT1; NAS 1.55:209692/VOL1/PT1; L-17758A/VOL1/PT1; No Copyright; Avail: CASI; A99, Hardcopy; A10, Microfiche

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

20000031534 NASA Ames Research Center, Moffett Field, CA USA
Propulsion Airframe Integration Advisory Group Report
Bencze, Dan, NASA Ames Research Center, USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 1, pp. 31-39; In English; See also 20000031532; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche

This paper presents The Propulsion Airframe Integration Advisory report in viewgraph form. The approach of the advisory group is to identify and prioritize technology elements (1.0 Inlet Issues, 2.0 Nozzle Issues, 3.0 Nacelle Design, and 4.0 Airframe Integration).
CASI
Propulsion; Airframes; Nacelles; Aerodynamic Configurations; Inlet Nozzles

20000031535 NASA Ames Research Center, Moffett Field, CA USA
Cycle 2 Nonlinear Design Optimization Analytical Cross Checks
Bencze, Dan, NASA Ames Research Center, USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 1, pp. 45-73; In English; See also 20000031532; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The objectives of the Cycle 2 Nonlinear Design Optimization Anlaytical Cross Checks are to: 1) Understand the variability in the predicted performance levels of the nonlinear designs arising from the use of different inviscid (full potential/Euler) and viscous (Navier-Stokes) analysis methods; and 2) Provide the information required to allow the performance levels of all three designs to be validated using the data from the NCV (nonlinear Cruise Validation) model test.
Derived from text
Nonlinearity; Design Analysis; Aerodynamic Configurations; Performance Prediction; Optimization; Airframes

20000031536 NASA Ames Research Center, Moffett Field, CA USA

Airplane Mesh Development with Grid Density Studies

Cliff, Susan E., NASA Ames Research Center, USA; Baker, Timothy J., Princeton Univ., USA; Thomas, Scott D., Sterling Software, Inc., USA; Lawrence, Scott L., NASA Ames Research Center, USA; Rimlinger, Mark J., Sterling Software, Inc., USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 1, pp. 75-145; In English; See also 20000031532; Original contains color illustrations; No Copyright; Avail: CASI; A04, Hardcopy; A10, Microfiche

Automatic Grid Generation Wish List Geometry handling, including CAD clean up and mesh generation, remains a major bottleneck in the application of CFD methods. There is a pressing need for greater automation in several aspects of the geometry preparation in order to reduce set up time and eliminate user intervention as much as possible. Starting from the CAD representation of a configuration, there may be holes or overlapping surfaces which require an intensive effort to establish cleanly abutting surface patches, and collections of many patches may need to be combined for more efficient use of the geometrical representation. Obtaining an accurate and suitable body conforming grid with an adequate distribution of points throughout the flow-field, for the flow conditions of interest, is often the most time consuming task for complex CFD applications. There is a need for a clean unambiguous definition of the CAD geometry. Ideally this would be carried out automatically by smart CAD clean up software. One could also define a standard piece-wise smooth surface representation suitable for use by computational methods and then create software to translate between the various CAD descriptions and the standard representation. Surface meshing remains a time consuming, user intensive procedure. There is a need for automated surface meshing, requiring only minimal user intervention to define the overall density of mesh points. The surface mesher should produce well shaped elements (triangles or quadrilaterals) whose size is determined initially according to the surface curvature with a minimum size for flat pieces, and later refined by the user in other regions if necessary. Present techniques for volume meshing all require some degree of user intervention. There is a need for fully automated and reliable volume mesh generation. In addition, it should be possible to create both surface and volume meshes that meet guaranteed measures of mesh quality (e.g. minimum and maximum angle, stretching ratios, etc.).

Derived from text

Grid Generation (Mathematics); Computational Fluid Dynamics; Computer Aided Design; Aircraft; Density (Mass/Volume)

20000031537 NASA Langley Research Center, Hampton, VA USA

High Reynolds Number Predictions for the Baseline Arrow Wing at Mach 2.48

Rivers, Melissa, NASA Langley Research Center, USA; Wahls, Richard, NASA Langley Research Center, USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 1, pp. 147-169; In English; See also 20000031532; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The NASA High Speed Research (HSR) Program is intended to establish a technology base enabling industry development of an economically viable and environmentally acceptable second generation high speed civil transport (HSCT). The objective of the Configuration Aerodynamics task of the program is the development of aerodynamic drag reduction, stability and control, and propulsion airframe integration technologies required to support the HSCT development process. Aerodynamic design tools are being developed, evaluated, and validated through ground based experimental testing. In addition, methods for ground to flight scaling are being developed and refined.

Author

High Reynolds Number; Mach Number; Arrow Wings; Aerodynamic Configurations; High Speed; Civil Aviation; Computational Fluid Dynamics

20000031538 NASA Langley Research Center, Hampton, VA USA

Applications of Parallel Processing in Configuration Analyses

Sundaram, Ppchuraman, Boeing Co., USA; Hager, James O., Boeing Co., USA; Biedron, Robert T., NASA Langley Research Center, USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 1, pp. 171-203; In English; See also 20000031532; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The paper presents the recent progress made towards developing an efficient and user-friendly parallel environment for routine analysis of large CFD problems. The coarse-grain parallel version of the CFL3D Euler/Navier-Stokes analysis code, CFL3Dhp, has been ported onto most available parallel platforms. The CFL3Dhp solution accuracy on these parallel platforms has been verified with the CFL3D sequential analyses. User-friendly pre- and post-processing tools that enable a seamless transfer from sequential to parallel processing have been written. Static load balancing tool for CFL3Dhp analysis has also been implemented for achieving good parallel efficiency. For large problems, load balancing efficiency as high as 95% can be achieved even when large number of processors are used. Linear scalability of the CFL3Dhp code with increasing number of processors

has also been shown using a large installed transonic nozzle boattail analysis. to highlight the fast turn-around time of parallel processing, the TCA full configuration in sideslip Navier-Stokes drag polar at supersonic cruise has been obtained in a day. CFL3Dhp is currently being used as a production analysis tool.
Author
Parallel Processing (Computers); Computational Fluid Dynamics; Aerodynamic Configurations; Navier-Stokes Equation; Applications Programs (Computers)

20000031540 NASA Langley Research Center, Hampton, VA USA
Unstructured Grid Euler Method Assessment for Aerodynamics Performance Prediction of the Complete TCA Configuration at Supersonic Cruise Speed
Ghaffari, Farhad, NASA Langley Research Center, USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 1, pp. 287-308; In English; See also 20000031532; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

Unstructured grid Euler computations, performed at supersonic cruise speed, are presented for a proposed high speed civil transport configuration, designated as the Technology Concept Airplane (TCA) within the High Speed Research (HSR) Program. The numerical results are obtained for the complete TCA cruise configuration which includes the wing, fuselage, empennage, diverters, and flow through nacelles at Mach 2.4 for a range of angles-of-attack and sideslip. The computed surface and off-surface flow characteristics are analyzed and the pressure coefficient contours on the wing lower surface are shown to correlate reasonably well with the available pressure sensitive paint results, particularly, for the complex shock wave structures around the nacelles. The predicted longitudinal and lateral/directional performance characteristics are shown to correlate very well with the measured data across the examined range of angles-of-attack and sideslip. The results from the present effort have been documented into a NASA Controlled-Distribution report which is being presently reviewed for publication.
Author
Unstructured Grids (Mathematics); Euler Equations of Motion; Performance Prediction; Supersonic Speed; Aerodynamic Configurations; Computational Fluid Dynamics; Civil Aviation

20000031541 NASA Langley Research Center, Hampton, VA USA
Unstructured Navier-Stokes Analysis of Full TCA Configuration
Frink, Neal T., NASA Langley Research Center, USA; Pirzadeh, Shahyar Z., NASA Langley Research Center, USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 1, pp. 309-327; In English; See also 20000031532; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This paper presents an Unstructured Navier-Stokes Analysis of Full TCA (Technology Concept Airplane) Configuration. The topics include: 1) Motivation; 2) Milestone and approach; 3) Overview of the unstructured-grid system; 4) Results on full TCA W/B/N/D/E configuration; 5) Concluding remarks; and 6) Future directions.
CASI
Navier-Stokes Equation; Unstructured Grids (Mathematics); Aerodynamic Configurations; Supersonic Transports; Computational Fluid Dynamics; Applications Programs (Computers)

20000031542 NASA Ames Research Center, Moffett Field, CA USA
Skin Friction Drag Predictions: Summary of CFD Cross Checks, Wing/Body
Lawrence, Scott, NASA Ames Research Center, USA; Klopfer, Goetz, NASA Ames Research Center, USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 1, pp. 333-353; In English; See also 20000031532; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The objective of the present study was to address the questions of: 1) how reliably or consistently the Navier-Stokes methods and processes used by the various organizations can predict integrated skin friction drag, and 2) how well the methods can predict trends within a family of optimized configurations. As a first step, all available skin friction drag predictions were accumulated to obtain a mean and standard deviation for the TCA (Technology Concept Airplane) baseline and each of the optimized configurations. It is observed that the optimization process has had little effect on the predicted skin friction drags. The variation in the mean that is observed is dwarfed by the standard deviations. In order to understand the reasons for the relatively large spreads in the computed results, a number of auxiliary computations have been performed using the UPS and OVERFLOW codes in an effort to identify and quantity potential sources of the variations.
Author
Skin Friction; Computational Fluid Dynamics; Body-Wing Configurations; Aerodynamic Drag; High Speed; Civil Aviation

20000031543 DYNACS Engineering Co., Inc., Renton, WA USA

TCA and Symmetric Model Viscous Drag Predictions

Kandula, Max, DYNACS Engineering Co., Inc., USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 1, pp. 355-425; In English; See also 20000031532; Original contains color illustrations; No Copyright; Avail: CASI; A04, Hardcopy; A10, Microfiche

A CFD analysis with the OVERFLOW code was carried out to determine the viscous drag for the symmetric TCA wing/body configuration (angle of attack alpha=0 deg) at wind tunnel Reynolds number (Mach 0.7 through 2.4) and at flight Reynolds number (Mach 0.9 through 2.4). Detailed local and chordwise averaged skin friction coefficients were computed at two selected Mach numbers (M=0.9 and 2.4). The predicted viscous drag, local and averaged skin friction coefficients were compared with the flat plate theories (based on two-dimensional boundary layer theories) of Sommer-Short and Frankl-Voishel. Skin friction coefficients were evaluated for the baseline TCA (Technology Concept Aircraft) configuration at M=0.9 and M=2.4 at both flight and wind tunnel Reynolds number and corresponding to cruise angles of attack. The purpose of the study was to establish the accuracy of the flat plate skin friction theories for HSCT (High Speed Civil Transport) applications.

Author

Viscous Drag; Performance Prediction; Computational Fluid Dynamics; Symmetry; Civil Aviation; Supersonic Speed; Turbulence Models

20000031544 Boeing Co., Long Beach, CA USA

Feasibility Study of a TCA Symmetric Model for Accurate Skin-Friction Measurements

Mendoza, Raul, Boeing Co., USA; Sundaram, Pichuraman, Boeing Co., USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 1, pp. 427-475; In English; See also 20000031532; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

Computational results from different CFD codes have been observed to produce significant differences in viscous drag predictions for HSCT configurations. Therefore, the HSR Configuration Aerodynamics (CA) community has proposed testing a TCA symmetric model in an effort to obtain wind-tunnel data useful in the validation of Navier-Stokes viscous drag predictions. This paper presents some initial computations to assess the feasibility of such a model and help define an appropriate test program.

Author

Feasibility; Computational Fluid Dynamics; Skin Friction; Supersonic Transports; Wind Tunnel Tests; Aerodynamic Configurations; Symmetry

20000031545 Boeing Commercial Airplane Co., Seattle, WA USA

Historic Background on Flat Plate Turbulent Flow Skin Friction and Boundary Layer Growth

Kulfan, Robert M., Boeing Commercial Airplane Co., USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, No. 1, pp. 477-513; In English; See also 20000031532; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

Recent CFD validation studies have shown significant variations in viscous drag predictions between the various methods used by the NASA and industry HSCT organizations. The methods include Navier Stokes CFD codes in which the viscous forces are part of the solutions, and predictions obtained from the different fully turbulent flow flat plate skin friction drag equations used by the various organizations. The initial objective of this study was to provide an experimental database of fully turbulent flow skin friction measurements on flat plate adiabatic surfaces at subsonic through supersonic Mach numbers and for a wide range of Reynolds numbers. The database could then be used as the initial step in resolving the differences in the viscous predictions. This database, was originally assembled in 1960 from selected experiments conducted prior to that time period. The criteria used to select the appropriate test data are described in the reference. Data were also found on turbulent boundary layer velocity profiles and it was therefore possible to analyze other boundary layer properties such as shape factor, displacement thickness and boundary layer thickness. The data presented in this note was scanned from the figures in the report and then digitized using a highly accurate PC screen digitizer. The digitized data will be released in a report early in 1998. In the process of extracting the data, statistical analyses were made between the test data and the corresponding predictions of various fully turbulent flat plate skin friction prediction methods. An improved method of predicting compressible turbulent skin friction drag was developed. Boundary layer profile data measurements are also included along with a new method for predicting boundary layer growth characteristics. These include approximate velocity profile representation, boundary displacement thickness, and boundary layer thickness.

Author

Civil Aviation; Computational Fluid Dynamics; Flat Plates; Skin Friction; Supersonic Speed; Turbulent Flow; Turbulent Boundary Layer

20000031546 NASA Ames Research Center, Moffett Field, CA USA

CA Testing Workshops: Process, Issues, Results

Kennelly, Robert A., Jr., NASA Ames Research Center, USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 1, pp. 515-537; In English; See also 20000031532; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This presentation will describe the organization and conduct of the workshops, list the topics discussed, and conclude with a more-detailed examination of a related set of issues dear to the presenters heart. Because the current HSCT configuration is expected to have (mostly) turbulent flow over the wings, and because current CFD predictions assume fully-turbulent flow, the wind tunnel testing to date has attempted to duplicate this condition at the lower Reynolds numbers attainable on the ground. This frequently requires some form of artificial boundary layer trip to induce transition near the wing's leading edge. But this innocent-sounding goal leads to a number of complications, and it is not clear that present-day testing technology is adequate to the task. An description of some of the difficulties, and work underway to address them, forms the "Results" section of this talk. Additional results of the testing workshop will be covered in presentations by other team members.
Author

Aerodynamic Configurations; Presentation; Teams; Supersonic Transports; Wind Tunnel Tests; Conferences

20000031547 NASA Langley Research Center, Hampton, VA USA

High Reynolds Number Assessment of Boundary Layer Transition Trip Drag at Mach 2.48 on HSCT Configuration

Wahls, Richard, NASA Langley Research Center, USA; Rivers, Melissa, NASA Langley Research Center, USA; Magee, Todd, Boeing Co., USA; Novean, Michael, Boeing Co., USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 1, pp. 539-569; In English; See also 20000031532; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The NASA High Speed Research (HSR) Program is intended to establish a technology base enabling industry development of an economically viable and environmentally acceptable second generation high speed civil transport (HSCT). The HSR program consists of work directed towards several broad technology areas, one of which is aerodynamic performance. The objective of the Configuration Aerodynamics task of the Aerodynamic Performance technology area is the development of aerodynamic drag reduction, stability and control, and propulsion airframe integration technologies required to support the HSCT development process. Towards this goal, computational and empirical based aerodynamic design tools are being developed, evaluated, and validated through ground based experimental testing. In addition, methods for ground to flight scaling are being developed and refined. Successful development of validated design and scaling methodologies will result in improved economy of operation for an HSCT and reduce uncertainty in full-scale flight predictions throughout the development process.
Author

High Reynolds Number; Boundary Layer Transition; Mach Number; Supersonic Transports; Aerodynamic Configurations; Drag Reduction; Computational Fluid Dynamics

20000031548 Boeing Co., Long Beach, CA USA

Experimental Bias and Precision Errors: Requirements, Analysis, and Recommendations

Novean, Michael G. B., Boeing Co., USA; Magee, Todd E., Boeing Co., USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 1, pp. 571-619; In English; See also 20000031532; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

Tight error bars on experimental data are required in order to meet HSCT (High Speed Civil Transport) performance requirements. This paper aims to deal with the need for these requirements and their impact upon desired testing accuracy. The definition of some terminology sets the stage for a brief review of how some of the accuracy requirements were generated. Error analyses or estimates from many of the wind tunnels used in HSR testing are presented. The sensitivity of performance coefficients to selected instrumentation accuracies is discussed. Uncertainties due to data corrections are acknowledged as another source of error. Future improvements to both facilities and test processes are suggested.
Author

Bias; Error Analysis; Precision; Supersonic Transports; Wind Tunnel Tests; Data Processing

20000031549 Boeing Co., Long Beach, CA USA

BCAG Design Optimization Activities

Conner, Roy S., Boeing Co., USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 1, pp. 625-692; In English; See also 20000031532; Original contains color illustrations; No Copyright; Avail: CASI; A04, Hardcopy; A10, Microfiche

The goal of this activity is the development and evaluation of multi-point optimization. The current task is limited to the high speed flight regime, subsonic cruise to supersonic cruise, and is based on the use of contemporary nonlinear aerodynamic tools. It is important to understand that the goal is more than a tool, the goal is a process. Tool building is part of the effort, but the result of the process building is the goal. Since multi-point optimization trades the aerodynamic efficiencies of multiple, disparate flight conditions, it appears that now is the time to begin optimizing to trimmed drag. The magnitude of trim drag at the conditions of interest for multi-point optimization is a significant fraction of the drag improvements due to nonlinear optimization itself. Multi-point optimization will require significant resources. The result of this major expenditure of resources will be far more meaningful if the exercise is based on trimmed drags. Longitudinal trim dictates that the empennage be added to the optimization model. Only complete configurations are acceptable. With the advent of the PTC configuration and through discussions with TI it also appears that for the foreseeable future complete configurations will include a canard. The one significant non-aerodynamic contributor to longitudinal trim is engine thrust forces. This will also be included. Another part of the overall goal of multi-point optimization is to include viscous effects wherever beneficial and/or necessary. The final, and perhaps most significant aspect of the goal of multi-point optimization is an understanding of who real customer is and how they will use the capability. The real customer will be the configuration designers working on the actual preliminary design of the actual airplane development program, somewhere in the future, sometime after HSR. More detail on how the process will be used on the airplane program and the implications of that use will be given later.
Author
Optimization; Design Analysis; Boeing Aircraft; Aerodynamic Configurations

20000031550 Research Inst. for Advanced Computer Science, Moffett Field, CA USA
SYN107 -MB Aerodynamic Shape Optimization Method: Recent Improvements and Current Status
Reuther, James, Research Inst. for Advanced Computer Science, USA; Rimlinger, Mark, Sterling Software, Inc., USA; Saunders, David, Sterling Software, Inc., USA; Hicks, Raymond, MCAT Inst., USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 1, pp. 693-775; In English; See also 20000031532; No Copyright; Avail: CASI; A05, Hardcopy; A10, Microfiche

This presentation provides an overview of the improvements and developments that have been incorporated into the aerodynamic optimization capability at NASA Ames Research Center. The main Aerodynamic Shape Optimization (ASO) tool, SYN 107-MB, will be discussed with attention to enhancements over the past year. The topics covered are: 1) Preliminary Navier-Stokes Design Capability (SYN107-MB); 2) AEROSURF Geometry Interface; 3) Improvements in Multiblock Mesh Motion; 4) Improvements in Parallel Performance and Communication; 5) Gradient Checks for Transonic Flows; 6) Gradient Checks for Supersonic Flows; 7) Navier-Stokes-Based constrained Design Example; and 8) Future Developments.
CASI
Aerodynamic Configurations; Optimization; Applications Programs (Computers); Software Development Tools; Navier-Stokes Equation; Design Analysis

20000031551 Boeing Co., Long Beach, CA USA
The Aeroshop Toolkit (AERODynamic Shape Optimization)
Unger, Eric R., Boeing Co., USA; Narducci, Robert P., Boeing Co., USA; Hager, James O., Boeing Co., USA; Hartwich, Peter M., Boeing Co., USA; Mendoza, Raul, Boeing Co., USA; Kuruvila, Geojoe, Boeing Co., USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 1, pp. 777-835; In English; See also 20000031532; Original contains color illustrations; No Copyright; Avail: CASI; A04, Hardcopy; A10, Microfiche

This paper is an overview of the capabilities and structure of BLB's new AEROSHOP design toolkit. The development of this code has taken place over the past year leveraging key components of previous work in Configuration Aerodynamics (CA) at Boeing Long Beach (BLB), and new tools developed in the High-Lift element. AEROSHOP is a versatile tool that will be used for all of BLB's CA optimization work. Also presented here is a sample cross-section of some of the recent optimization experiences using AEROSHOP on various problems from transonic flap optimization to integrated wing/body/nacelle/diverter/empennage design. The code is continuously being enhanced to extend its capabilities to configurations with canards, evaluating design sensitivities in a production mode using alternative methods, and fully exploiting parallel processing.
Author
Aerodynamic Configurations; Optimization; Software Development Tools; Aircraft Design; Applications Programs (Computers)

20000031552 MCAT Inst., Moffett Field, CA USA

TCA6 Configuration Optimization

Hicks, Raymond, MCAT Inst., USA; Rimlinger, Mark, Sterling Software, Inc., USA; Reuther, James, Research Inst. for Advanced Computer Science, USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 1, pp. 837-927; In English; See also 20000031532; No Copyright; Avail: CASI; A05, Hardcopy; A10, Microfiche

This report describes the status of two optimization studies in configuration design using the TCA6 baseline and the Ames optimized geometry (970103). The first study discussed will be flap/slat optimization using SYN87 with a single block grid with finite difference and adjoint gradients at Mach 0.90 and an angle of attack of 4.0 degrees. The second study presented is a preliminary comparison of the improvement in the lift/drag ratio obtainable with axisymmetric and bifurcated inlets on the TCA6 baseline configuration. The flap/slat optimization study was conducted in three phases. Four arbitrarily chosen high lift devices were examined during phase 1. Flap and slat deflections were accomplished by vertical shear and both inboard and outboard flaps and slats of constant percent chord were explored. The inboard and outboard ends of the high lift devices were aligned with the free stream direction and gaps were not modeled. Flap and slat ends and edges blended smoothly into the wing. The second phase of the study involved the use of approximate geometry of the outboard flap and slat of the TCA6 wind tunnel model. The slat used during this phase had a constant chord of 26% of the local wing chords while the flap had a constant chord of 22% of the local wing chords. Both high lift devices had the same span as the wind tunnel model. Deflections were again accomplished by using vertical shear. The third phase used an improved grid with better cell aspect ratios in critical areas of the computational space and rotation instead of shear was used for deflections. The outboard slat for this phase had the same linearly varying chord lengths as the wind tunnel model. All flap/slat studies were conducted using SYN87SB. Preliminary results from an optimization study conducted to determine whether axisymmetric or bifurcated inlets give better improvement in the lift-drag ratio for the TCA6 Baseline configuration will also be presented. This study used the multi-block Euler/Navier-Stokes design code SYN107MB in Euler mode. The results presented here cannot be considered definitive since a major limitation in the design code was found early in the optimization process which prevented further progress. At the time of this writing in late January the code had not been fixed so the results shown will be approximately one month old. However, the data comparisons for the two inlet types presented is considered to be valid and is probably an indication of the final outcome of the study.

Author

Aerodynamic Configurations; Optimization; Flapping; Wind Tunnel Models; Computational Fluid Dynamics

20000031646 Purdue Univ., School of Aeronautics and Astronautics, West Lafayette, IN USA

Laminar-Turbulent Transition in High-Speed Compressible Boundary Layers: Continuation of Elliptic-Cone Experiments ***Final Report, 15 Nov. 1996-14 Nov. 1999***

Schneider, Steven P.; Collicott, Steven H.; Jan. 31, 2000; 9p; In English

Contract(s)/Grant(s): F49620-97-1-0037

Report No.(s): AD-A373478; AFRL-SR-BL-TR-00-0026; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This grant supported experimental research into high-speed laminar-turbulent transition. While it began as a one-year effort extending our earlier work on elliptic cones, it became increasingly evident that the low quiet Reynolds number available in the Mach-4 quiet Ludwieg tube was limiting the usefulness of the measurements. Although useful results for instability and transition were nevertheless obtained, the emphasis shifted toward development of a high Reynolds number Mach-6 quiet Ludwieg tube. Instrumentation development also continued, in the form of a series of experiments carried out at low quiet Reynolds number in the existing Mach-4 Ludwieg tube. Experiments with the laser perturber, glow perturber, hot wire, laser-differential interferometer, and hot films are summarized. These experiments were carried out on elliptic cones, round cones, and a scramjet-inlet model.

DTIC

Boundary Layer Transition; Compressible Flow; Supersonic Flow; Boundary Layer Flow; Hypersonic Flow; Transition Flow

20000031776 Research Inst. of National Defence, Weapons and Protection Div., Tumba, Sweden

Large Eddy Simulation of Supersonic Base Flow ***Topical Report Storvirvelsimulering av Supersoniskt Basfloede***

Fureby, C.; Nilsson, Y.; Andersson, K.; Feb. 1999; ISSN 1104-9154; 32p; In English

Report No.(s): PB2000-103076; FOA-R-99-01043-310-SE; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Flow separation at the base of aerodynamic vehicles such as missiles, rockets and projectiles leads to the formation of a low-speed recirculation zone near the base. In this study, a computational capability based on a Large Eddy Simulation (LES) approach has been developed for predicting the flow around axisymmetric aerodynamic vehicles. In particular, the authors have focused on turbulent supersonic base flow over a cylindrical afterbody, with and without base bleed, corresponding to laboratory experiments as to allow direct comparison for a case with zero base bleed, whilst further simulations with base bleed have been

undertaken with the best performing subgrid model. Details of first and second order statistical quantities are presented and compared with experimental data. In general, good qualitative agreement is found whilst only good quantitative agreement is reached for the first order statistical moments, with the exception of the near wake region in which both good qualitative and quantitative agreement is achieved.
NTIS
Large Eddy Simulation; Supersonic Flow; Base Flow

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.

20000027697 National Science and Technology Council, Subcommittee on Transportation Research and Development, Washington, DC USA
National Research Agenda for Transportation and Sustainable Communities
Sep. 1999; 28p; In English
Report No.(s): PB2000-102554; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

This Plan, prepared by DOT for the NSTC Committee on Technology, serves as a benchmark for the future interagency cooperative efforts to optimize essential government research toward the attainment of critical aviation and air transportation goals. This report represents a broad new consensus among FAA, NASA, and DOD as to aviation goals agency roles in R&D to support civil aviation, and provides the foundation for developing more-integrated program plans in the future. This document provides an overview of the full spectrum of aviation research in the context of long-term objectives and programmatic structures. It is an important element in implementing the formal R&D partnership established between FAA and NASA in October 1998.
NTIS
Air Transportation; Research and Development

20000028399 Cherry (R. G. W.) and Associates Ltd., Hertford, UK
A Benefit Analysis for Nitrogen Inerting of Aircraft Fuel Tanks Against Ground Fire Explosion ***Final Report***
Cherry, Ray; Warren, Kevin; Dec. 1999; 117p; In English
Report No.(s): AD-A373137; DOT/FAA/AR-99/73; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The International Cabin Safety Research Technical Group's Survivable Accidents Database was used to identify past worldwide transport aircraft accidents and extract detailed data for those accidents where explosion was an issue in the survivability of the occupants. Each of these accidents was analysed in depth to assess the number of lives and injuries that might be saved if the fuel tanks were protected with nitrogen inerting systems. The objective of this analysis was to assess the potential benefits, in terms of reducing fatalities and injuries, resulting from three methods of aircraft fuel tank inerting. The methods analyzed were ground nitrogen inerting in centre fuel tank only, ground nitrogen inerting in all fuel tanks, and onboard nitrogen inerting in all fuel tanks. Thirteen accidents to transport category aircraft were identified during the period from 1966 to 1995 that may have involved a fuel tank' explosion. A mathematical technique was used to model each accident scenario and a Monte Carlo simulation was used to assess a high, median, and low value for the total achievable benefits.
DTIC
Nitrogen; Aircraft Fuels; Fuel Tanks; Fires; Propellant Explosions

20000029583 NASA Langley Research Center, Hampton, VA USA
The Fight Deck Perspective of the NASA Langley AILS Concept
Rine, Laura L., NASA Langley Research Center, USA; Abbott, Terence S., NASA Langley Research Center, USA; Lohr, Gary W., NASA Langley Research Center, USA; Elliott, Dawn M., NASA Langley Research Center, USA; Waller, Marvin C., NASA Langley Research Center, USA; Perry, R. Brad, NASA Langley Research Center, USA; January 2000; 52p; In English
Contract(s)/Grant(s): RTOP 576-02-11-17
Report No.(s): NASA/TM-2000-209841; L-17820; NAS 1.15:209841; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Many US airports depend on parallel runway operations to meet the growing demand for day to day operations. In the current airspace system, Instrument Meteorological Conditions (IMC) reduce the capacity of close parallel runway operations; that is, runways spaced closer than 4300 ft. These capacity losses can result in landing delays causing inconveniences to the traveling public, interruptions in commerce, and increased operating costs to the airlines. This document presents the flight deck perspective component of the Airborne Information for Lateral Spacing (AILS) approaches to close parallel runways in IMC. It represents the ideas the NASA Langley Research Center (LaRC) AILS Development Team envisions to integrate a number of components and procedures into a workable system for conducting close parallel runway approaches. An initial documentation of the aspects of this concept was sponsored by LaRC and completed in 1996. Since that time a number of the aspects have evolved to a more mature state. This paper is an update of the earlier documentation.
Derived from text
Airline Operations; Runways; Airborne Equipment; Aircraft Approach Spacing; Air Navigation

20000031353 National Center for Atmospheric Research, Boulder, CO USA
Results of Holdover Time Testing of Type 4 Anti-Icing Fluids With the Improved NCAR Artificial Snow Generation System ***Final Report***
Rasmussen, Roy M.; Hills, Allan; Landolt, Scott; Knight, Charlie; Dec. 1999; 44p; In English
Report No.(s): AD-A372713; DOT/FAA/AR-99/10; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report discusses improvements to the National Center for Atmospheric Research (NCAR) artificial snow generation machine and the results of anti-icing fluid testing with the improved machine. The improvements include: (1) improved control of snowfall rate, (2) development of an integrated frosticator plate/snow mass measuring system, (3) automatic control and recording of the experiment, and (4) direct control of the frosticator plate temperature through an area heater controlled by an interface unit. This improved machine was used to conduct anti-icing fluid holdover time tests on several Type IV fluids. The results showed the typical inverse relationship between holdover time and snowfall rate. The results from the improved machine were compared to previous natural and artificial snow tests conducted by the University of Quebec at Chicoutimi and NCAR and showed good agreement in general. Tests with varying snowfall rates showed a factor of 1.5 to 2.0 longer holdover time for nonconstant snowfall rates. This result suggests that natural snow conditions are not as severe as the constant snowfall rate conditions tested in the laboratory. Causes for the longer holdover time were suggested to be: (1) the longer time available for the absorption of the melted snow water, and (2) the warmer temperatures experienced during the time varying rate tests as compared to the constant rate tests.
DTIC
Automatic Control; Deicers; Ice Prevention

20000031873 Army Safety Center, Fort Rucker, AL USA
FLIGHTFAX: Army Aviation Risk-Management Information. Volume 28, Number 1
Jan. 2000; 12p; In English
Report No.(s): AD-A373329; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Many aviators have their own ideas about how to mitigate the risks associated with blowing snow. As part of the winter academic program, it may be useful to survey aircrews to determine which hazards they consider the most severe, and evaluate the effectiveness of the controls that are in place. From such a survey, necessary upgrades to winter training plans and development of new controls can be put in place. Winter has been a regular on the calendar for a long, long time. There's nothing we can do about that, even if we wanted to. In fact, the very predictability of changing seasons gives us time to plan our training for the different kinds of flying problems each season brings. If you haven't already done it, get your refresher training, review FM 1-202, and be alert to the hazards associated with winter flying.
DTIC
Flight Crews; Aircraft Safety; Aircraft Accidents; Aircraft Pilots

20000031967 Federal Aviation Administration, Technical Center, Atlantic City, NJ USA
Application of the FAATC Risk Management Process to the Airport Vulnerability Assessment and Analysis Project (AVAP) ***Final Report***
Lazarick, R. T., Federal Aviation Administration, USA; Jun. 1999; 26p; In English
Contract(s)/Grant(s): DT059-96-D-00410
Report No.(s): PB2000-101748; DOT/FAA/AR-99/95; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

This report summarizes Abacus Technology Corporation's experience in conducting risk/vulnerability assessments of airports in support of the Federal Aviation Administration (FAA) Airport Vulnerability Assessment and Analysis Project (AVAP).

The report describes Abacus Technology's findings regarding application and effectiveness of the Risk Management Process developed for the FAATC and of the selected automated tool methodologies.
NTIS
Airport Security; Threat Evaluation

20000031968 Federal Aviation Administration, Technical Center, Atlantic City, NJ USA
Guide to the FAATC Risk Management Process ***Final Report***
Lazarick, R. T., Federal Aviation Administration, USA; Jun. 1999; 90p; In English
Contract(s)/Grant(s): DT059-96-D-00410
Report No.(s): PB2000-101747; DOT/FAA/AR-99/94; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy

This report provides a summary and guidance to the Federal Aviation Administration (FAA) William J. Hughes Technical Center (FAATC) Risk Management Process, developed by Abacus Technology Corporation in conjunction with the FAATC. Abacus Technology used the Risk Management Process in conducting risk/vulnerability assessments of airports in support of the FAA Airport Vulnerability Assessment and Analysis Project (AVAP). The report includes a discussion of risk management concepts; a summary of the process modeling approach used to diagram the process steps; a description of the process; a complete diagram of the process; and a glossary of terms and concepts.
NTIS
Airport Security; Automation; Management Planning

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.

20000031391 Pennsylvania State Univ., Dept. of Computer Science and Engineering, University Park, PA USA
Obstacle Detection Algorithms for Aircraft Navigation: Performance Characterization of Obstacle Detection Algorithms for Aircraft Navigation ***Final Report, 1 Aug. 1997 - 31 Dec. 1999***
Kasturi, Rangachar, Pennsylvania State Univ., USA; Camps, Octavia, Pennsylvania State Univ., USA; Coraor, Lee, Pennsylvania State Univ., USA; Jan. 28, 2000; 221p; In English
Contract(s)/Grant(s): NAG2-1152
Report No.(s): TR-CSE-00-002; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

The research reported here is a part of NASA's Synthetic Vision System (SVS) project for the development of a High Speed Civil Transport Aircraft (HSCT). One of the components of the SVS is a module for detection of potential obstacles in the aircraft's flight path by analyzing the images captured by an on-board camera in real-time. Design of such a module includes the selection and characterization of robust, reliable, and fast techniques and their implementation for execution in real-time. This report describes the results of our research in realizing such a design. It is organized into three parts. Part I. Data modeling and camera characterization; Part II. Algorithms for detecting airborne obstacles; and Part III. Real time implementation of obstacle detection algorithms on the Datacube MaxPCI architecture. A list of publications resulting from this grant as well as a list of relevant publications resulting from prior NASA grants on this topic are presented.
Derived from text
Algorithms; Obstacle Avoidance; Air Navigation; Aircraft Performance; Supersonic Transports; Detection

20000031604 Department of the Navy, Washington, DC USA
Air-Delivered Position Marking Device and Method
Woodall, Robert C., Jr, Inventor; Sep. 14, 1999; 9p; In English
Patent Info.: Filed 8 Dec. 97,; US-Patent-Appl-SN-08,986,983; US-Patent-5,951,346
Report No.(s): AD-D019576; No Copyright; Avail: US Patent and Trademark Office, Microfiche

An air-deliverable global positioning system (GPS) position marking device and method involves the operations of providing an air-deliverable GPS position marking device, launching the device into flight through the air to a desired location, arming the device in response to launching the device into flight, firing a detonation mechanism contained in the device when the device is at the desired location after receipt of a magneto-inductive transmission so as to generate a predetermined pressure in an interior chamber of the device that causes ejection of a payload assembly from the interior chamber, initiates inflation of an inflatable

flotation body of the payload assemble, and initiates communications between a GPS receiver and transmitter unit in the payload assembly and a remote station to determine the position of the position marking device at the desired location.
DTIC
Airdrops; Global Positioning System; Position (Location); Tracking (Position); Patents

20000031643 Air Force Research Lab., Human Effectiveness Directorate, Wright-Patterson AFB, OH USA
Flying Complex Approaches Using a Head-Up Display: Effects of Visibility and Display Type ***Final Report***
Snow, Michael P.; Reising, John M.; Liggett, Kristen K.; Barry, Timothy P.; Apr. 1999; 9p; In English; Prepared in collaboration with North Coast Simulations, Dayton, OH.
Contract(s)/Grant(s): Proj-2403
Report No.(s): AD-A373468; AFRL-HE-WP-TR-2000-0011; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Air traffic controllers will soon have the ability to direct pilots to fly complex landing approaches. The imminent replacement of the Instrument landing System (ILS) with a landing system based on Global Positioning System (GPS) technology at major airports in the USA will allow pilots to fly landing approaches with curved segment and varying descent rates. From a military standpoint, flying complex approaches will allow better threat avoidance and operational security. Current head up primary flight references may be inadequate to fly these complex approaches, but the proposed alternative a pathway in the sky and/or synthetic terrain display may involve too much clutter for a head up display (HUD), depending on visibility conditions. This paper reports findings research in the Air Force Research Laboratory designed to create a next generation, head up primary flight reference that will allow pilots to fly complex approach and weapon delivery paths regardless of visibility conditions. The conclusions reported herein are that a head up pathway in the sky display will greatly improve pilots' ability to fly complex flight paths in comparison to the current military standard head up display regardless of external visibility. Synthetic terrain in the HUD will improve situation awareness in reduced visibility conditions.
DTIC
Instrument Landing Systems; Flight Paths; Landing Aids; Head-Up Displays; Air Navigation

20000031724 NASA Goddard Space Flight Center, Greenbelt, MD USA
Enabling Spacecraft Formation Flying in Any Earth Orbit Through Spaceborne GPS and Enhanced Autonomy Technologies
Bauer, F. H., NASA Goddard Space Flight Center, USA; Bristow, J. O., NASA Goddard Space Flight Center, USA; Carpenter, J. R., NASA Goddard Space Flight Center, USA; Garrison, J. L., NASA Goddard Space Flight Center, USA; Hartman, K. R., NASA Goddard Space Flight Center, USA; Lee, T., Computer Sciences Corp., USA; Long, A. C., Computer Sciences Corp., USA; Kelbel, D., Computer Sciences Corp., USA; Lu, V., Computer Sciences Corp., USA; How, J. P., Stanford Univ., USA; Busse, F., Stanford Univ., USA; Dec. 14, 2000; 35p; In English; GPS Workshop, Feb. 2000, Breckenridge, CO, USA; Sponsored by European Space Agency, International Organization
Contract(s)/Grant(s): RTOP 572-315-80-21-78; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Formation flying is quickly revolutionizing the way the space community conducts autonomous science missions around the Earth and in space. This technological revolution will provide new, innovative ways for this community to gather scientific information, share this information between space vehicles and the ground, and expedite the human exploration of space. Once fully matured, this technology will result in swarms of space vehicles flying as a virtual platform and gathering significantly more and better science data than is possible today. Formation flying will be enabled through the development and deployment of spaceborne differential Global Positioning System (GPS) technology and through innovative spacecraft autonomy techniques, This paper provides an overview of the current status of NASA/DoD/Industry/University partnership to bring formation flying technology to the forefront as quickly as possible, the hurdles that need to be overcome to achieve the formation flying vision, and the team's approach to transfer this technology to space. It will also describe some of the formation flying testbeds, such as Orion, that are being developed to demonstrate and validate these innovative GPS sensing and formation control technologies.
Author
Global Positioning System; Earth Orbits; Autonomy; Spacecraft Launching; Technology Assessment

20000031866 Colorado Univ., Colorado Center for Astrodynamics Research, Boulder, CO USA
Spaceborne Differential GPS Applications ***Final Report, 1 Sep. 1997 - 31 Aug. 1999***
Axelrad, Penina; Highsmith, Dolan; Reichert, Angela; Feb. 17, 2000; 71p; In English
Contract(s)/Grant(s): N00014-97-1-G025; Proj-81-0337-97
Report No.(s): AD-A373747; PA-99-305; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

This final technical report summarizes the research performed by the Colorado Center for Astrodynamics Research (CCAR) for the Naval Research Laboratory (NRL) on Spaceborne Differential GPS Applications over the period 0l September 1997 through 31 August 1999. The primary focus of our work was on relative state estimation using GPS data from two vehicles. Data from a spaceborne experiment conducted by NASA was used for algorithm development and performance analysis. An auxiliary area of research was the identification and reduction of multipath errors in GPS observations. This effort is key to full utilization of GPS for high precision applications such as attitude determination, differential GPS, and relative navigation. The report comprises three documents descrIbing the research. The first two are conference papers presented at ION GPS 99 describing the relative navigation and multipath research. The third is a doctoral dissertation research proposal written by Dolan Highsmith, summarizing his research on this project and plans for future work.
DTIC
Spaceborne Experiments; Global Positioning System; Technology Utilization

20000032020 Communications Research Lab., Tokyo, Japan
Precise Positioning Technique Using GPS, 4, Digital Sampling Data Acquisition Method for ”PRESTAR”
Imae, Mitchito, Communications Research Lab., Japan; Kiuchi, Hitoshi, Communications Research Lab., Japan; Kaneko, Akihiro, Communications Research Lab., Japan; Sugimoto, Yuji, Communications Research Lab., Japan; Review of the Communications Research Laboratory; Dec. 1993; ISSN 0914-9279; Volume 39, No. 4, pp. 229-235; In Japanese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The ionospheric delay variation is one of the largest error sources for the precise space geodesy such as VLBI and GPS. The prototype version of the ”PRESTAR” had a problem of the precise measurement of the L2 carrier signal for the precise compensation of the ionospheric delay. to solve this problem, the ”digital sampling method” is applied to the prototype version of the ”PRESTAR” for the pseudo-range measurement. The experimental results show the digital sampling method successfully works for the precise ionospheric delay compensation. This paper mainly describe the concept and the hardware of the digital sampling method for the phase measurements.
Author
Positioning; Global Positioning System; Sampling; Data Acquisition

20000032021 Communications Research Lab., Tokyo, Japan
Precise Positioning Technique Using GPS, 3, Differential GPS Receiver
Kiuchi, Hitoshi, Communications Research Lab., Japan; Sugimoto, Yuji, Communications Research Lab., Japan; Kameyama, Kiyonobu, Communications Research Lab., Japan; Review of the Communications Research Laboratory; Dec. 1993; ISSN 0914-9279; Volume 39, No. 4, pp. 215-227; In Japanese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Differential measurement method is never fail to high accuracy geodesy. We discussed about differential method applied to the GPS receivers. Differential GPS in the early stage, the received signal from GPS was dealt with noise and pseudo range was measured by correlation processing, just like as VLBI. A new differential GPS receiver, called PRESTAR, has been developed by CRL, and is designed to be used in positioning and ionospheric measurement. PRESTAR reproduces the signal clocks and carriers from the received signal, and pseudo range is measured by the phase of them. We discussed about this system applied to the stability measurement of the atmosphere.
Author
Global Positioning System; Positioning; Systems Engineering

20000032023 Communications Research Lab., Tokyo, Japan
Precise Positioning Technique Using GPS, 1, Overview of Development of Prestar System
Sugimoto, Yuji, Communications Research Lab., Japan; Review of the Communications Research Laboratory; Dec. 1993; ISSN 0914-9279; Volume 39, No. 4, pp. 181-208; In Japanese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This paper presents an overview of the development of the PRESTAR system, which is followed by papers describing its details. Geodesists and geophysicists have been awaiting the development of a small, inexpensive and precise positioning system that can be used for baselines up to several hundreds of kilometers. Global positioning system (GPS) is currently the best system for this purpose.
Derived from text
Positioning; Global Positioning System

20000032024 Communications Research Lab., Tokyo, Japan

Precise Positioning Technique Using GPS, 7, Results of the Experiments by "PRESTAR"

Takahashi, Yukio, Communications Research Lab., Japan; Sugimoto, Yuji, Communications Research Lab., Japan; Imae, Michito, Communications Research Lab., Japan; Kiuchi, Hitoshi, Communications Research Lab., Japan; Kaneko, Akihiro, Communications Research Lab., Japan; Kurihara, Noriyuki, Communications Research Lab., Japan; Review of the Communications Research Laboratory; Dec. 1993; ISSN 0914-9279; Volume 39, No. 4, pp. 247-255; In Japanese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We conducted many experiments using the Global Positioning System receiver "PRESTAR". "PRESTAR" is a unique receiver that receives only one Global Positioning System (GPS) satellite at each observation. The original data analysis software was developed to remove the phase ambiguity. The method to remove ambiguities and the results of experiments with PRESTAR are described. Its precision was found to be 5 mm and the ionospheric delay correction is possible. However, there remain some problems to obtain good data constantly.

Author

Global Positioning System; Positioning; Receivers

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.

20000027686 Office National d'Etudes et de Recherches Aerospatiales, Chatillon, France

Aerodynamic Performance Analysis of the Hypersonic Airbreathing Vehicle JAPHAR

Dueveau, P., Office National d'Etudes et de Recherches Aerospatiales, France; Hallard, R., Office National d'Etudes et de Recherches Aerospatiales, France; Novelli, P., Office National d'Etudes et de Recherches Aerospatiales, France; Eggers, T., Office National d'Etudes et de Recherches Aerospatiales, France; Sep. 10, 1999; 11p; In English; Prepared in cooperation with DLR, Braunschweig, Germany.

Report No.(s): AD-A373370; ISABE-99-7286; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

In 1997, DLR and ONERA joined in a common project called JAPHAR (Joint Airbreathing Propulsion for Hypersonic Application Research). The main objective of this project is to develop and test at ground a dual mode ramjet engine (DMR) combining both subsonic and supersonic combustion regimes. The other objective is to define a methodology to establish the thrust-minus-drag balance of the DMR on an experimental vehicle to be flown between Mach number 4 and 8. This paper presents an ongoing effort for the design of an integrated propulsive system for JAPHAR flight test vehicle. Forebody, inlet and nozzle aerodynamic studies are conducted in close connection with the system studies and require CFD analysis as well as wind tunnel experiments. A forebody parametric study based on turbulent Navier-Stokes calculations was conducted at ONERA. The main results are given in the paper, demonstrating the advantage of DLR waverider forebody. In addition, this paper gives an overview of the inlet studies conducted so far at ONERA. An internal compression inlet was designed and tested in S3MA wind tunnel, between Mach 3 and 5.5. Navier-Stokes calculations are in progress to calibrate numerical codes and to provide combustion people with realistic entry flow field conditions. Lastly, a preliminary design of a SERN nozzle (Single Expansion Ramp Nozzle) relying on inviscid calculations is presented.

DTIC

Aerodynamic Characteristics; Air Breathing Engines; Navier-Stokes Equation; Hypersonic Vehicles; Supersonic Combustion; Supersonic Speed; Inviscid Flow; Flight Test Vehicles

20000031341 Dayton Univ. Research Inst., Research Inst., OH USA

Preliminary Recommendation for the Electronic Display of Graphical Aircraft Maintenance Information ***Interim Report, Nov. 1995-Feb. 1999***

Quill, Laurie; Kancler, David; Pohle, Patrick; Masquelier, Barbara L.; Feb. 1999; 19p; In English

Contract(s)/Grant(s): F41624-98-F-5017; AF Proj. 1710

Report No.(s): AD-A373566; AFRL-HE-WP-TR-1999-0196; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The conversion of paper schematic diagrams to electronic display presentations requires identification and analysis of associated cognitive demands. Schematic diagrams are typically used by expert maintainers in troubleshooting aircraft faults.

These expert maintainers must rely on skill, rule, and knowledge-based behavior to successfully use these diagrams. In this task, the Applied Cognitive Task Analysis (ACTA) method was employed to elicit knowledge associated with using schematic diagrams for troubleshooting. Eleven F-15 maintenance technicians were interviewed. Results showed that schematic diagrams not only support the basic abilities required for troubleshooting; they also allow for visualization of the dynamic flow of system relations and process activities on the aircraft. The ACTA method identified the cues and strategies used to mentally depict system flow. Efforts to convert schematic diagrams to electronic display presentations should support the basic troubleshooting abilities, as well as the cues and strategies that depict dynamic system flow.
DTIC
Aircraft Maintenance; Display Devices

20000031539 Boeing Co., Long Beach, CA USA
TCA Full Configuration Performance and S and C Characteristics
Martin, Grant L., Boeing Co., USA; Mendoza, Raul, Boeing Co., USA; Kubiatko, Paul, Boeing Co., USA; Agrawal, Shreekant, Boeing Co., USA; 1998 NASA High-Speed Research Program Aerodynamic Performance Workshop; December 1999; Volume 1, Part 1, pp. 205-286; In English; See also 20000031532; Original contains color illustrations; No Copyright; Avail: CASI; A05, Hardcopy; A10, Microfiche

During the past year, Boeing Long Beach has made major strides in Computational Fluid Dynamics (CFD) analysis of increasingly complex HSCT configurations using both serial and parallel computational platforms. Presented herein are full configuration Euler and Navier-Stokes solutions obtained using CFL3D on the NAS C-90, J-90, IBM SP-2, Cray T3E, and SGI Origin2OOO. Solutions were obtained for the 1.675% TCA wing/body (W/B), wing/body/empennage (W/B/E), wing/body/nacelle/ diverter (W/B/N/D), and the full configuration (W/B/N/D/E). Other CFL3D full configuration computations were performed on the 1.5% Modular Controls Model to assess the longitudinal and lateral-directional characteristics of the TCA at M (sub infinity) = 2.4. Limited full configuration predictions were obtained at M (sub infinity) = 0.9. In order to validate the predicted force and moments, a number of comparisons are made between predicted results and the available test data from the NASA Langley Unitary Plan Wind Tunnel (UPWT) and the transonic 16' TT facility.
Author
Technology Utilization; Computational Fluid Dynamics; Performance Prediction; Control Stability; Wing Nacelle Configurations; Body-Wing and Tail Configurations

20000031719 Federal Aviation Administration, Atlantic City, NJ USA
Vertical Drop Test of a Shorts 3-30 Airplane ***Final Report***
Abramowitz, Allan; Ingraham, Philip A.; McGuire, Robert; Nov. 1999; 121p; In English
Report No.(s): AD-A373749; DOT/FAA/AR-99/87; No Copyright; Avail: CASI; A02, Microfiche; A06, Hardcopy

A Short Brothers PLC, Model SD 3-30, airplane was subjected to a vertical impact drop test at the Federal Aviation Administration (FAA) William J. Hughes Technical Center, Atlantic City International Airport, New Jersey. The objective of the test was to determine the impact response of the fuselage, seat tracks, seats, and anthropomorphic test dummies on a high-wing, commuter type airplane. The test was conducted to simulate the vertical velocity component of a severe, but survivable, crash impact. A final impact velocity of 30 feet per second was therefore selected. The airplane was configured in a typical maximum gross weight flight condition, including seats, simulated occupants, fuel, and cargo. The Shorts 3.30 is a twin turboprop, 30-passenger regional transport airplane. The total test weight of the airplane was 21,210 pounds. The internal seating arrangement consisted of pilot and copilot seats, eight rows of standard passenger seats, and two nonstandard seats mounted in the aisle. Twentyone of the 28 seats were occupied by mannequins; the remaining seven seats were occupied by instrumented anthropomorphic test dummies. The Shorts 3-30 fuel system is unique insofar as the two fuel tanks are located on top of the fuselage as opposed to the more conventional location in the wings. During the drop test, a massive amount of simulated fuel spilled into the passenger compartment. The stiff structure of the airplane allowed for only small amounts of airframe crushing. As a result, the fuselage experienced high G(max) levels of approximately 90 g's with an impact pulse duration of 15 ins. The stiff structure also prevented fuselage crushing which allowed the airplane to maintain a protective shell. The seat tracks remained attached to the fuselage. However, 23 of the 26 passenger seats experienced structural failure. The crew seats were undamaged.
DTIC
Drop Tests; Crashes; Impact Tests; Crashworthiness

20000032041 RAND Corp., Santa Monica, CA USA

Aging Aircraft: Implications for Programmed Depot Maintenance and Engine-Support Costs

Pyles, Raymond; Feb. 1999; 11p; In English

Report No.(s): AD-A373688; RAND-CT-149; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

RAND Project AIR FORCE'S long term interest in the topic of aging aircraft was rekindled in 1994, when we participated in the Air Force Scientific Advisory Board Summer Study that raised technical concerns about the viability of retaining certain aircraft past their original design lives. In 1997, the National Research Council's report on aging USAF aircraft reinforced those concerns. At that time, we initiated a modest Air Force sponsored research effort focused on emerging technical challenges for aircraft maintenance activities. Last summer we built on that technical background to examine the potential effects that aging aircraft would have on the costs of programmed depot maintenance (PDM) and engine support. The results of that work are documented in the annotated briefing that has been made available to the subcommittee. This year, we have broadened our review to cover other support and modernization activities where aircraft age may affect costs and readiness.

DTIC

Aircraft Maintenance; Life Cycle Costs; Logistics Management

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.

20000027680 Pratt and Whitney Aircraft, West Palm Beach, FL USA

Direct Fuel Cooled Composite Structure

Medwick, Denis G., Pratt and Whitney Aircraft, USA; Castro, Joaquin H., Pratt and Whitney Aircraft, USA; Sobel, David R., United Technologies Corp., USA; Boyet, Guy, Office National d'Etudes et de Recherches Aerospatiales, France; Vidal, Jean-Pierre, SNECMA, France; Jan. 1999; 6p; In English; Prepared in cooperation with United Technologies Research Center, East Hartford, CT., ONERA, Palaiseau, France, and SEP Div., of SNECMA, Saint-Medard-en-Jalles, France

Report No.(s): AD-A373274; ISABE-99-7284; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

One of the more challenging aspects of hypersonic propulsion systems is the development of lightweight structure that can withstand the severe conditions associated with flight up to Mach 8. Currently, the Pratt & Whitney expendable scramjet engine concept utilizes a metallic combustor, based upon high temperature alloys with integral, endothermic fuel cooling. There is the potential for reduction in propulsion system weight and cost, and increase in thermal management margin if these high density metal alloys can be replaced with advanced composite materials. Pratt & Whitney (P&W) and ONERA (Office National d'Etudes et de Recherches Aerospatiales) are prime contractors in a joint U. S. Air Force (USAF) / French Directeur Generale d'Armements (DGA) sponsored advanced technology demonstration program that combines direct fuel cooling with a hot structure manufactured from advanced composite materials. The four-year Advanced Combustion Chamber Concepts (AC3) Program proposes to combine these two innovative technologies in two proof-of-concept demonstrations. P&W is supported in this program by the United Technologies Research Center (UTRC), and ONERA is supported by SEP (Societie d'Europeenne de Propulsion) Division of SNECMA (Societie National d'Etudes et de Construction de Moteurs d'Aviation) Corporation. Phase 1 of AC3 will be a sector panel test, while Phase 2 is planned as a fabrication and test of a 2-D scramjet combustor.

DTIC

Composite Structures; Combustion Chambers; Liquid Cooling; Supersonic Combustion Ramjet Engines; Hypersonic Flight; Endothermic Fuels; Engine Design

20000027682 Defence Evaluation Research Agency, Farnborough, UK

Lifting and Life Extension of Fracture Critical Aeroengine Components

Boyd-Lee, A. D., Defence Evaluation Research Agency, UK; Harrison, G. F., Defence Evaluation Research Agency, UK; Painter, D., Defence Evaluation Research Agency, UK; Sep. 10, 1999; 11p; In English

Report No.(s): AD-A373285; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Engine removal costs and the consequences of grounding aircraft are many times greater than the replacement component costs. The paper addresses several areas where DERA has been instrumental in generating procedures to enable more of the

available safe service lives of fracture critical aeroengine components to be utilized. More effective methods for handling non-finite results (discontinued fatigue tests) are explored. General life extension via support of the
DTIC
Aircraft Engines; Engine Parts; Service Life; Fatigue Tests; Costs

20000028381 SRS Technologies, Huntsville, AL USA
Innovative Visual Modeling Environment for Turbine Engine Reverse Modeling Aid Program (TERMAP) ***Final Report, 28 Apr. 1999 - 28 Jan. 2000***
Atkins, Leigh E.; DePlachett, Charles P.; Jan. 27, 2000; 19p; In English
Contract(s)/Grant(s): F33615-99-C-2929
Report No.(s): AD-A373135; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Report developed under SBIR contract for topic AF99-2O5. There is a need for an innovative Graphical User Interface (GUI), or Visual Modeling Environment, for the Turbine Engine Reverse Modeling Aid Program (TERMAP) which is used by DoD, NASA, and contractors for modeling gas turbine engine propulsion systems. The development of such a user-friendly, innovative GUI was undertaken during this Phase I by SRS Technologies. This Phase I SBIR contract has resulted:%in a user-friendly, Windows- based GUI which meets and exceeds the performance objectives. This report summarizes the Phase I results and software capabilities. Visual TERMAP can import existing TERMAP input files or create new engine cycle configurations using the drag and drop interface. Visual TERMAP automatically tracks station numbers and TERMAPTs Parameter Index Codes (PICs). Compressor and turbine maps can be scaled and plotted. Visual TERMAP also performs trade studies and graphs results using an integrated graphing program. Software deliverables include the Visual TERMAP software program.
DTIC
Propulsion System Configurations; Propulsion System Performance; Gas Turbine Engines; Reverse Engineering

20000028395 Defence Evaluation Research Agency, Farnborough, UK
Hydrogen Peroxide Based Propulsion System for Micro Air Vehicle Applications
Cheung, W. S., Defence Evaluation Research Agency, UK; Tilston, J. R., Defence Evaluation Research Agency, UK; Sep. 10, 1999; 7p; In English
Report No.(s): AD-A373361; ISABE-99-7278; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

The miniaturisation of sensors and weapon system will enable the development of micro air vehicles (MAVs) for use in military and surveillance operations, such as signal jamming and intelligence gathering. However, the propulsion systems for MAVs will need to have a range of engine characteristics to satisfy operating requirements. The Propulsion Department of DERA proposed a hydrogen peroxide (H2O2), hybrid rocket/turbine engine for micro air vehicle propulsion. A feasibility study was carried out on the proposed engine and compared against parameters set out in a preliminary specification. The study shows that a bipropellant system with on-board oxygen gives the best flight endurance. The engine configuration will consist of a convergent/divergent nozzle and a ducted fan. This engine can largely meet the physical requirements. It can also meet the indoor and urban reconnaissance requirement of 1-hour flight endurance. The H2O2 engine compares favorably with a rival engine (micro gas turbine). However, the hydrogen peroxide system has an important advantage that it is an established technology and carries considerably less technical risk.
DTIC
Gas Turbines; Hydrogen Peroxide; Liquid Rocket Propellants; Propulsion System Configurations; Miniaturization

20000030660 Technion - Israel Inst. of Tech., Faculty of Aerospace Engineering, Haifa Israel
Solid Fuel Ramjet Regulation by Means of an Air Division Valve
Pelosi-Pinhas, Deborah, Technion - Israel Inst. of Tech., Israel; Gany, Alon, Technion - Israel Inst. of Tech., Israel; Jan. 1999; 8p; In English
Report No.(s): AD-A373397; ISABE-99-7245; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

An analytical study was conducted, developing a theoretical model for the regulation of solid fuel ramjets by means of an air division valve. The solid fuel ramjet motor is the simplest air-breathing propulsion means for supersonic flights. However, the variable flight conditions over the operating envelope of altitudes and velocities significantly affect the motor performance. Regulation requirement was defined in this study as the motor capability of operating at a constant, desirable fuel to air ratio over a wide range of flight conditions. The adopted method is based on an air division valve, which drives a part of the incoming air from the diffuser through a bypass to the aft-mixing end of the combustion chamber. The model takes into account the parameters that influence the burning rate of the solid fuel (air mass flow, port diameter) and formulates a general regulation law for the division valve. The method was checked for specific cases, considering different trajectories. The control law provided a good

regulation by means of the division valve, determining the instantaneous opening state of the valve that assures a constant optimal fuel to air ratio over the operating envelope.
DTIC
Air Breathing Engines; Ramjet Engines; Burning Rate; Flight Conditions; Solid Propellants

20000031333 Air Force Research Lab., Propulsion Directorate, Wright-Patterson AFB, OH USA
Control of Flow Separation on a Turbine Blade by Utilizing Tail Extensions ***Final Report, 4 Sep. 1997-15 Mar. 1999***
Murawski, C. G.; Sep. 1999; 40p; In English
Contract(s)/Grant(s): Proj-3066
Report No.(s): AD-A373507; AFRL-PR-WP-TR-1999-2100; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An experimental study was conducted in a two-dimensional linear cascade, focusing on the suction surface of a low pressure turbine blade. Flow Reynolds numbers, based on exit velocity and suction surface length were varied from 50,000 to 300,000. The axial chord of the blades was varied using tail extenders from 0% to 15% beyond design. The effects of Reynolds number on a low pressure turbine cascade blade with tail extensions was investigated. This study has shown that for certain cases, changing the axial chord of a low pressure turbine blade by utilizing tail extensions provided a clear improvement in boundary layer behavior which results in better overall performance. There was no additional advantage when the tail extensions were longer than 6.1% of the axial chord. The shortest tail extension resulted in the greatest zone of performance enhancement. The longer tail extension resulted in a smaller region of performance enhancement.
DTIC
Gas Turbines; Tail Assemblies; Turbulent Flow; Turbine Blades; Boundary Layer Separation; Separated Flow

20000031737 Taitech, Inc., Beavercreek, OH USA
Advanced Airbreathing Hydrocarbon-Fueled Aero-Engine Concepts ***Final Report, May 1996-Jul 1998***
Streby, G. D.; Mathur, T.; Chen, T. H.; Eakins, W.; Jul. 1999; 89p; In English
Contract(s)/Grant(s): F33615-96-C-2670; AF Proj. 1025
Report No.(s): AD-A372847; AFRL-PR-WP-TR-1999-2038; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

An advanced long duration, high enthalpy direct connect water cooled supersonic combustion research facility has been designed and manufactured; initial calibrations have been performed. This facility provides the AFRL/PRS division with in house capability to conduct long duration scramjet combustor research and development. Simulations of flight Mach numbers to 7+ at flight dynamic pressures to 2000 psf are achievable using four separate facility nozzles (M=1.8, 2.2, 2.6, and 3.0). These efforts are directed at developing advanced propulsion systems for future Air Force high speed flight vehicles. In less than twenty four months, concepts and ideas for a scramjet test facility were analyzed and developed, and components were designed, fabricated, and installed to build an operational scramjet test facility. Components were assembled in Test Cell 22 at AFRL Bldg. 18E. The majority of the components (vitiator, inlet transition, facility nozzle, isolator sections, and fixed and traversing probes) are water cooled. The combustor test section provides a wide parametric space for evaluating fuel injection and flameholding concepts. The AFRL/PRSS Scramjet Test Facility is fully operational and a series of preliminary calibration tests have been completed to fully document the flow characteristics at the combustor inlet for a wide range of flight Mach numbers and dynamic pressures. Data from these tests are presented herein.
DTIC
Supersonic Combustion Ramjet Engines; Hypersonic Aircraft; Air Breathing Engines; Aerospace Vehicles

20000031779 Federal Data Corp., Hampton, VA USA
Fuel Plume Image Mixing Analysis Formulation With Proper Treatment of Non-Constant Velocity Flowfields
Mekkes, Gregory L., Federal Data Corp., USA; March 2000; 15p; In English
Contract(s)/Grant(s): NAS1-96013; RTOP 706-51-21-10
Report No.(s): NASA/CR-2000-209868; NAS 1.26:209868; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A previously developed technique allows an estimate of integral mixing to be obtained from an image of laser scattered light from particle seeded fuel in the hypervelocity flow through a scramjet combustor. This previous mixing analysis formulation contains an assumption of a constant velocity flowfield across the plane of the fuel plume image. For high-speed scramjet combustors, the velocity flowfield is quite uniform and an assumption of constant velocity works well. Applying this same mixing analysis technique to fuel plume images obtained from a mid-speed scramjet combustor makes it desirable to remove the constant velocity assumption. This is due to the non-uniform velocity flowfields present in mid-speed scramjet combustors. A new

formulation of the mixing analysis methodology is developed and presented so that the technique can be applied to a mid-speed scramjet combustor without the need to assume a constant velocity flowfield.
Author
Fuel Flow; Plumes; Mixing; Velocity Distribution; Supersonic Combustion Ramjet Engines; Image Processing; Formulations

20000031884 American Inst. of Aeronautics and Astronautics, New York, NY USA
The Diagnostics and the Fault Detection of Gas Turbine Engines by Using Different Neural Networks
Torella, Giovanni; Torella, Roberto; Sep. 10, 1999; 10p; In English
Report No.(s): AD-A373338; ISABE-99-7282; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper deals with the results of a research carried out for the evaluation of Neural Networks for engine diagnostics. The study continues the works made in the past on the same subject. Now the main aim is to find new methods for improving the effectiveness of Neural Nets. The results presented here concern with two different Neural Nets: the Back Propagation Neural Networks (BPNN) and the Adaptive Resonance Theory Neural Networks (ART1-2). As regarding BPNN particular attention is paid to the improvement of training time and their robustness. The study of ART1-2 considers the use and the insertion of the probability of fault happening in the training patterns. The paper shows in full details all activities carried out as well as all improvements with respect to past results.
DTIC
Neural Nets; Robustness (Mathematics); Gas Turbine Engines

20000031895 Defence Science and Technology Organisation, Airframes and Engines Div., Melbourne Australia
Preliminary Finite Element Analysis of a Compressor Disk in the TF30 Engine
Faragher, J. S.; Antoniou, R. A.; Jan. 2000; 49p; In English
Contract(s)/Grant(s): Proj-
Report No.(s): AD-A373490; DSTO-TR-0915; DODA-AR-011-166; Copyright; Avail: Defense Technical Information Center (DTIC)

AMRL has been developing expertise in finite element analysis (PEA) of engine components, particularly compressor and turbine discs. The fourth stage Low Pressure Compressor (LPC) disc of the TF30 engine in the F-111 aircraft was chosen as the first component for detailed analysis after being identified as a prime candidate for the retirement-for-cause lifting methodology. This report describes a preliminary study of the stresses in this component. Two benchmark examples which show close agreement between PEA stress results and analytical solutions are presented. The PEA results confirm the critical location for low cycle fatigue failure specified by the OEM. The assembly loads are shown to significantly increase the mean and peak stresses but not the cyclic stress range. The thermal stresses are shown to be an order of magnitude smaller than the stresses caused by the rotation of the disc. The analysis shows that the most severe stresses produced in the disc under typical engine operating conditions are much lower than the yield stress of the disc material (Ti-8-l-l), which suggests a very conservative design. Recommendations are made for developing models that will more realistically represent the loads on the disc and the interaction with other components in order to determine whether the design is really as conservative as the current analysis suggests.
DTIC
Finite Element Method; Compressors

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).

20000029574 NASA Langley Research Center, Hampton, VA USA
National Transonic Facility Characterization Status
Bobbitt, C., Jr., NASA Langley Research Center, USA; Everhart, J., NASA Langley Research Center, USA; Foster, J., NASA Langley Research Center, USA; Hill, J., NASA Langley Research Center, USA; McHatton, R., NASA Langley Research Center, USA; Tomek, W., NASA Langley Research Center, USA; [2000]; 34p; 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 2000-0293; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper describes the current status of the characterization of the National Transonic Facility. The background and strategy for the tunnel characterization, as well as the current status of the four main areas of the characterization (tunnel calibration, flow quality characterization, data quality assurance, and support of the implementation of wall interference corrections) are presented. The target accuracy requirements for tunnel characterization measurements are given, followed by a comparison of the measured tunnel flow quality to these requirements based on current available information. The paper concludes with a summary of which requirements are being met, what areas need improvement, and what additional information is required in follow-on characterization studies.
Author
Transonic Wind Tunnels; Characterization

20000031969 Federal Aviation Administration, Office of Communications, Navigation and Surveillance Systems, Washington, DC USA
FAA Heliport/Vertiport Lighting Conference: Proceedings ***Final Report***
Smith, R. D., Federal Aviation Administration, USA; Nov. 1999; 276p; In English
Report No.(s): PB2000-101746; DOT/FAA/ND-99/1; No Copyright; Avail: CASI; A03, Microfiche; A13, Hardcopy

As the Vertical Flight Industry moves into instrument flight rules (IFR) operations at heliports, it has become apparent to both FAA and the users that there is research and development to be done on heliport lighting. With the civil tiltrotor now in production at Bell Helicopter, there is also work to be done on vertiport lighting. In looking at the heliport lighting research done by the FAA over the last decade and the resulting advisory circular guidance, it is clear that there are many more questions than answers. to answer these questions would require much more in the way of resources than what is likely to be available in the near future. With this in mind, the FAA sought the advice of the aviation community on how best to proceed with the limited available resources.
NTIS
Heliports; Lighting Equipment; Landing Aids

20000031970 Texas A&M Univ., Texas Transportation Inst., College Station, TX USA
Update: Implementation of the Micropaver Pavement Management System on TXDOT Aviation Division Airfields (Revised) ***Interim Report, 1 Sep. 1998 - 31 Aug. 1999***
Freeman, T., Texas A&M Univ., USA; Dresser, G. B., Texas A&M Univ., USA; Apr. 1999; 98p; In English
Contract(s)/Grant(s): Proj. 7-1913
Report No.(s): PB2000-101736; Rept-1913-2; No Copyright; Avail: CASI; A02, Microfiche; A05, Hardcopy

This report describes the status of MicroPAVER implementation at the airports included in the Texas Aeronautical Facilities Plan. In 1998, the research team inspected 41 airports with 56 runways, 54 primary aprons, and 62 primary taxiways. to date, 245 airports have been inspected and the resulting information entered into the MicroPAVER database. For this report, the aprons and taxiways were inspected, but the data was not entered. The list of airports is included in Table 1. The runways at all 245 airports have been inspected and the resulting information entered into the MicroPAVER database. Aprons and taxiways have been inspected at nearly 80 of these airports.
NTIS
Runways; Pavements; Airports

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.

20000028286 Lunar and Planetary Inst., Houston, TX USA
Second Annual HEDS-UP Forum
Duke, Michael B., Editor, Lunar and Planetary Inst., USA; 1999; 284p; In English; 2nd; HEDS-UP, 6-7 May 1999, Houston, TX, USA; Sponsored by Lunar and Planetary Inst., USA; See also 20000028287 through 20000028299
Contract(s)/Grant(s): NASW-4574
Report No.(s): LPI-Contrib-979; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

HEDS-UP (Human Exploration and Development of Space-University Partners) conducted its second annual forum on May 6-7, 1999, at the Lunar and Planetary Institute in Houston. This year, the topics focused on human exploration of Mars, including considerations ranging from systems analysis of the transportation and surface architecture to very detailed considerations of surface elements such as greenhouses, rovers, and EVA suits. Ten undergraduate projects and four graduate level projects were presented with a total of 13 universities from around the country. Over 200 students participated on the study teams and nearly 100 students attended the forum meeting.
Author
Students; Mars Exploration; Mars (Planet); University Program

20000028288 California Inst. of Tech., Pasadena, CA USA
A New Plan for Sending Humans to Mars: The Mars Society Mission
Hirata, Christopher, California Inst. of Tech., USA; Greenham, Jane, California Inst. of Tech., USA; Brown, Nathan, California Inst. of Tech., USA; Shannon, Derek, California Inst. of Tech., USA; Second Annual HEDS-UP Forum; 1999, pp. 35-54; In English; See also 20000028286; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Optimal cost and safety will be instrumental not only in sending humans to Mars, but also in achieving the political support and scientific consensus that will allow such an endeavor to begin. The Mars Society Mission (MSM) was created to improve upon the safety, cost, and political viability of previous plans, with emphasis on the NASA Reference Mission 3.0. The Mars Society Mission is a complete description of a possible 5-human expedition to the Red Planet targeted at the 2011 (cargo) and 2014 (crew) launch opportunities. All components are capable of performing in any succeeding launch windows. The Mars Society Mission features: (1) Increased redundancy of design for reduced development. For instance, the Mars Society Mission's Mars Ascent Vehicle (MAV) and Earth Return Vehicle (ERV) derive from a common Crew Return Vehicle (CRV, distinct from that planned for the International Space Station). (2) Increased redundancy for maximum safety. A CRV will accompany the outbound habitat module, and in the event of habitat failure would be able to support the crew until arrival on Mars or Earth. After a 612-day surface stay, both the MAV and ERV will accompany the crew during the return to Earth. If either ERV or MAV fails, or Mars orbital rendezvous does not take place, either component could return the crew. (3) The Qahira Interplanetary Transportation System (QITS, pronounced "Keats"). QITS is based on the Qahira launch vehicle, a Delta-IV inspired heavy lifter with only two new components, the Qahira Booster Core (QBC) with 4 RS-68 engines, and the Qahira Upper Stage (QUS), with 1 RD0120 engine. The maximum configuration, the Q3041, is capable of sending 55 MT trans-Mars. (4) Detailed and improved trajectories, including a 3/2 Hohmann transfer orbit for the ERV that minimizes propellant boil-off and reduces launch facility strain, as well as optimal trajectories for cargo, free-return, and return from Mars surface. (5) "Piggyback" payload capabilities to reduce launch costs and encourage additional planetary science missions. (6) Minimal assembly in Earth orbit, specifically no more than one Earth orbit rendezvous. (7) No nuclear thermal rocketry, and no activation of nuclear power sources until Mars surface. (8) A large science payload, with 13.7 MT available for the 2014 mission. The 2014 Mars Society Mission will consist of five launches, four of which will use the Q3041 configuration: Payload (A) ERV in June 201 1; (B) Cargo including power, hydrogen and science in October 2011; (C) MAV and In-Situ Resource utilization in November, 2011; and (D) Habitat module in January 2Ol4. A Q1310 configuration will launch Payload (E) Crew in CRV, also in January, 2014. Extensive computer programming and simulation were used to design launch vehicles and trajectories. Comparative risk analysis indicates that the Mars Society Mission has significantly less risk of failure than the Reference Mission 3.0 or Mars Direct.
Author
Mars Surface; Safety; Mars (Planet); Mars Landing; Mars Exploration; Manned Mars Missions

20000028290 Georgia Inst. of Tech., Space Systems Design Lab., Atlanta, GA USA
Mars Scenario-Based Visioning: Logistical Optimization of Transportation Architectures
Charania, Ashaf, Georgia Inst. of Tech., USA; St.Germain, Brad, Georgia Inst. of Tech., USA; Salinas, Roberto, Georgia Inst. of Tech., USA; Tooley, Jeffrey, Georgia Inst. of Tech., USA; Cowart, Kris, Georgia Inst. of Tech., USA; Sakai, Tadashi, Georgia Inst. of Tech., USA; Sorensen, Kirk, Georgia Inst. of Tech., USA; Wilson, Shannan, Georgia Inst. of Tech., USA; Second Annual HEDS-UP Forum; 1999, pp. 77-96; In English; See also 20000028286; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The purpose of this conceptual design investigation is to examine transportation forecasts for future human missions to Mars. Scenario-Based Visioning is used to generate possible future demand projections. These scenarios are then coupled with availability, cost, and capacity parameters for indigenously designed Mars Transfer Vehicles (solar electric, nuclear thermal, and chemical propulsion types) and Earth-to-Orbit launch vehicles (current, future, and indigenous) to provide a cost-conscious dual-phase launch manifest to meet such future demand. A simulator named M-SAT (Mars Scenario Analysis Tool) is developed using this method. This simulation is used to examine three specific transportation scenarios to Mars: a limited "flags and

footprints" mission, a more ambitious scientific expedition similar to an expanded version of the Design Reference Mission from NASA, and a long-term colonization scenario. Initial results from the simulation indicate that chemical propulsion systems might be the architecture of choice for all three scenarios. With this mind, "what if' analyses were performed which indicated that if nuclear production costs were reduced by 30% for the colonization scenario, then the nuclear architecture would have a lower life cycle cost than the chemical. Results indicate that the most cost-effective solution to the Mars transportation problem is to plan for segmented development, this involves development of one vehicle at one opportunity and derivatives of that vehicle at subsequent opportunities.
Author
Launch Vehicles; Propulsion System Configurations; Manned Mars Missions; Launchers; Spacecraft Design; Engine Design; Spacecraft Configurations

20000028292 California Univ., Berkeley, CA USA
Interactive Design Environment: Tools for Facilitating Communication and Collaboration Among Universities on Projects Related to a Mars Mission
Fellowes, A., California Univ., USA; Peshkess, A., California Univ., USA; Black, B., California Univ., USA; Buchanan, B., California Univ., USA; Wellins, B., California Univ., USA; Chang, D., California Univ., USA; Smith, G., California Univ., USA; Rainsberry, P., California Univ., USA; Copenhaver, J., California Univ., USA; Mirczek, J., California Univ., USA; Second Annual HEDS-UP Forum; 1999, pp. 113-130; In English; See also 20000028286; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The HEDS-UP program is comprised of student groups from many different universities across the USA working independently on various aspects of the grand objective - a manned mission to Mars. The inherent value of the program is in the nature of the students working in it. Students offer a different perspective on an existing project. Their contribution is in bringing the off the wall ideas to the table, among others. Students are unbounded by tradition and precedents in methodology. This enables them to approach the problem from a unique angle. They have the potential to bring fresh ideas and new dimensions to the overall project, thus contributing something original rather than mimicking existing projects. With proper facilitation the HEDS-UP program can become an evolutionary dynamic environment in which ideas are proposed and tested under pressure and those with sufficient merit survive. Moreover, the incredibly cheap price of student labor gives the HEDS-UP program enormous potential to provide a substantial and lasting contribution to the Mars mission. The potential value of the projects completed by the HEDS-UP universities is limited by the geographical and academic separation of the universities, the short term nature of the projects, and insufficient input from NASA. If communication exists between the universities at all, it is minimal and limited to the conference. The projects are limited by the school term and the turn over rate of the participants is exceedingly high with an influx of new students each semester. This means that much of the work from previous semesters is lost as it is improperly passed on, incompletely understood, and consequently disregarded. There is no consistent method employed across the universities for storing the information and making it accessible to others in the field. Moreover the projects suffer from a dislocation from NASA itself. The insufficient feedback and inadequate resources for the projects limit their technical content. If a means of overcoming these limiting factors is found, the Mars mission project could then fully take advantage of the enormous pool of talent that currently exists within the HEDS-UP program. The combined projects offer the very real possibility of contributing to a mission to Mars without simply replicating what NASA is already fully equipped to do. Our design proposal set about to solve these existing problems so that the HEDS UP program can flourish. Better communication between university projects would lead to proposals that can be better integrated into an overall mission design.
Author
Manned Mars Missions; Mission Planning; Universities; Communication; Information Management; Information Transfer

20000029570 Macready (John A.), Mariposa, CA USA
First Steps into Space
Liston, Sally Macready, Liston (Sally Macready), USA; [1970]; In English; 7th; 7th Annual Meeting and Technical Display, 19-22 Oct. 1970, Houston, TX, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 70-1255; No Copyright; Avail: Issuing Activity, Hardcopy

This paper presents the First Steps Into Space. It discusses hazards such as lack of pressure, lack of oxygen, and intense cold associated with high altitude flying in the early years of 1920.
CASI
Flight Hazards; Supersonic Flight; Aerospace Environments

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.

20000030654 Old Dominion Univ., Engineering Management Dept., Norfolk, VA USA
Development of Response Surface Models for Rapid Analysis & Multidisciplinary Optimization of Launch Vehicle Design Concepts ***Final Report***
Unal, Resit, Old Dominion Univ., USA; [1999]; 53p; In English
Contract(s)/Grant(s): NAG1-2157
Report No.(s): ODURF-192121; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Multdisciplinary design optimization (MDO) is an important step in the design and evaluation of launch vehicles, since it has a significant impact on performance and lifecycle cost. The objective in MDO is to search the design space to determine the values of design parameters that optimize the performance characteristics subject to system constraints. Vehicle Analysis Branch (VAB) at NASA Langley Research Center has computerized analysis tools in many of the disciplines required for the design and analysis of launch vehicles. Vehicle performance characteristics can be determined by the use of these computerized analysis tools. The next step is to optimize the system performance characteristics subject to multidisciplinary constraints. However, most of the complex sizing and performance evaluation codes used for launch vehicle design are stand-alone tools, operated by disciplinary experts. They are, in general, difficult to integrate and use directly for MDO. An alternative has been to utilize response surface methodology (RSM) to obtain polynomial models that approximate the functional relationships between performance characteristics and design variables. These approximation models, called response surface models, are then used to integrate the disciplines using mathematical programming methods for efficient system level design analysis, MDO and fast sensitivity simulations. A second-order response surface model of the form given has been commonly used in RSM since in many cases it can provide an adequate approximation especially if the region of interest is sufficiently limited.
Author
Multidisciplinary Design Optimization; Launch Vehicles; Mathematical Models; Aircraft Design; Design Analysis

20000030743 NASA Langley Research Center, Hampton, VA USA
Nontangent, Developed Contour Bulkheads for a Single-Stage Launch Vehicle
Chauncey, K., NASA Langley Research Center, USA; Lepsch, Roger A., Jr., NASA Langley Research Center, USA; January - February 2000; 10p; In English; 37th; 37th Aerospace Sciences Meeting, 11-14 Jan. 1999, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 99-0835; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche

Dry weights for single-stage launch vehicles that incorporate nontangent, developed contour bulkheads are estimated and compared to a baseline vehicle with 1.414 aspect ratio ellipsoidal bulkheads. Weights, volumes, and heights of optimized bulkhead designs are computed using a preliminary design bulkhead analysis code. The dry weights of vehicles that incorporate the optimized bulkheads are predicted using a vehicle weights and sizing code. Two optimization approaches are employed. A structural-level method, where the vehicle's three major bulkhead regions are optimized separately and then incorporated into a model for computation of the vehicle dry weight, predicts a reduction of4365 lb (2.2 %) from the 200,679-lb baseline vehicle dry weight. In the second, vehicle-level, approach, the vehicle dry weight is the objective function for the optimization. For the vehicle-level analysis, modified bulkhead designs are analyzed and incorporated into the weights model for computation of a dry weight. The optimizer simultaneously manipulates design variables for all three bulkheads to reduce the dry weight. The vehicle-level analysis predicts a dry weight reduction of 5129 lb, a 2.6% reduction from the baseline weight. Based on these results, nontangent, developed contour bulkheads may provide substantial weight savings for single stage vehicles.
Author
Single Stage to Orbit Vehicles; Contours; Bulkheads; Design Analysis; Ellipsoids

20000031396 Wyoming Univ., Coll. of Engineering, Laramie, WY USA
Reduction of Base Drag on Launch Vehicles ***Final Report, Mar. - Nov. 1999***
Naughton, Jonathan, Wyoming Univ., USA; [1999]; 11p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG4-167
Report No.(s): UWAL-2000-01; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report describes the work accomplished during a first-year investigation of base drag reduction for launch vehicles. Interest in this work has arisen due to the large base areas associated with the current generation of launch vehicles. For example,

the X-33 and Venture Star configurations all have large base areas because of the aero-spike engines they use. Because of the large base-to-wetted area ratios of these vehicles, the majority of the vehicle drag is due to base drag. Based on previous research, there appears to be a means for reducing the base drag on such vehicles. A clear relationship between viscous fore-body drag and base drag was demonstrated. For subsonic flow conditions, an increase in fore-body drag causes a decrease in base drag. This base-drag reduction is a result of boundary layer effects at the base of the vehicle. The shear layer that develops from the boundary layer separating at the back of the vehicle is the conduit through which momentum is transferred from the high energy free-stream flow to the low-energy fluid in the base area. One way to think of the base drag is that it is the momentum required to accelerate this low-energy fluid. The boundary layer that develops on the fore body acts as an ”insulator” between the external flow and the low-energy air at the base. As the viscous fore-body drag is increased, the boundary layer thickness at the aft end of the fore body increases, thereby reducing the rate at which momentum is transferred to the base area. As a result of the lower momentum transfer (or reduced pumping), the base pressure coefficient rises resulting in a reduction of base drag.
Derived from text
Aerodynamic Drag; Drag Reduction; Launch Vehicles; Aircraft Engines; Base Pressure

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.

20000027671 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-99 Countdown Status Briefing
Jan. 30, 2000; In English; Videotape: 18 min. 16 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000025579; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

After an introduction by Bruce Buckingham (NASA Public Affairs), participants Jeff Spaulding (NASA Test Director, Scott Higginbotham (STS-99 Payload Manager), and Ed Priselac (Shuttle Weather Officer) proceed with the countdown status briefing. They expressed that the opening countdown was proceeding well and servicing of the cryotanks was completed. The launch pad closeouts continued and the tanking process was in order. There was a card failure in the data handling processor, so a backup system was used.
CASI
Space Transportation System; Space Shuttle Missions; Countdown; Launching

20000027706 NASA Johnson Space Center, Houston, TX USA
STS-103 Mission Highlights Resource Tape (1 of 2)
Mar. 01, 2000; In English; Videotape: 1 hr. 29 min. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000036030; JSC-1814; No Copyright; Avail: CASI; B04, Videotape-Beta; V04, Videotape-VHS

The STS-103 flight crew, Commander Curtis L. Brown, Pilot Scott J. Kelly, Mission Specialists Steven L. Smith, C. Michael Foale, John M. Grunsfeld, Claude Nicollier, and Jean-Francois Clervoy, are seen performing pre-launch activities such as crew suit-up, and ride out to the launch pad for a night launch. Also, included are various panoramic views of the shuttle on the pad. The crew is readied in the White Room for their mission. After the closing of the hatch and arm retraction, launch activities are shown including countdown, engine ignition, launch, and the separation of the Solid Rocket Boosters. Once on-orbit the primary objective is to capture and service the Hubble Space Telescope. Included are various live shots of the payload bay showing the flight support system, the orbiter replacement unit carrier and the forward fixture that house the new Fine Guidance System (FGS). Smith and Grunsfeld replaces and changes the sensor units during the first space walk of this mission. The second space walk by Nicollier and Foale includes the changing of the computer and installation of the FGS. This is tape 1 of 2, tape 2 has a report number of NONP-NASA-VT-2000036031.
CASI
Space Transportation System; Space Transportation System Flights; Discovery (Orbiter); Maintenance; Hubble Space Telescope

20000028407 NASA Kennedy Space Center, Cocoa Beach, FL USA

STS-71/Mir/Spacelab Landing at KSC

Jul. 07, 1995; In English; Videotape: 57 min. 27 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2000036562; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS

Live footage of various day landing views of the Spacecraft Atlantis are shown from different camera sites. Also shown is the re-entry and day landing of the spacecraft at Kennedy Space Center. Footage also includes touchdown, drag chute deployment, nose gear touchdown, and the ground recovery crew as they travel to the spacecraft. Atlantis crew, Commander Robert L. Gibson, Pilot Charles J. Precourt, Mission Specialists Ellen S. Baker, Bonnie J. Dunbar, Gregory J. Harbaugh, and the download crew from MIR-18 Norman E. Thagard, Vladimir Dezhurov, and Gennadiy Strekalov are also seen leaving the craft. Included is a phone conversation between President Clinton and the crew.

CASI

Spacecraft Landing; Touchdown; Reentry; Descent; Drag Chutes

20000028408 NASA Kennedy Space Center, Cocoa Beach, FL USA

STS-71/Mir/Spacelab Mission Update

Jul. 03, 1995; In English; Videotape: 19 min. 46 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2000036561; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

Live footage shows the crewmembers of STS-71 and Mir 18, Commander Robert L. Gibson, Pilot Charles J. Precourt, Mission Specialists Ellen S. Baker, Bonnie J. Dunbar, Gregory J. Harbaugh, MIR-19 crew upload Anatoly Solovyev and Nikolai Budarin, and MIR-18 crew download Norman E. Thagard, Vladimir Dezhurov, and Gennadiy Strekalov, on board the Russian Space Station Mir and the Atlantis spacecraft complex. The ten-member crew is shown participating in an interview. An animation of the undocking and fly-around of the Atlantis spacecraft is presented. Also shown is the commander of the STS-79 mission, discussing the undocking of the Atlantis Spacecraft.

CASI

Mir Space Station; Space Transportation System; Space Transportation System Flights; Atlantis (Orbiter); Space Laboratories; Space Station Modules; Spacecraft Docking

20000028409 NASA Johnson Space Center, Houston, TX USA

STS-30 Post Flight Press Conference

May 18, 1989; In English; Videotape: 58 min. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2000036554; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS

Live footage shows the crewmembers of STS-30, Commander David M. Walker, Pilot Ronald J. Grabe, Mission Specialists Norman E. Thagard, Mary L. Cleave and Mark C. Lee, participating in the Post Flight Press Conference. The astronauts took turns narrating the footage taken from the inside of the cockpit during lift-off. The crew answer questions from the audience as well as some of the NASA Centers. Included are various stills of Magellan, and some ground shots of the Florida Peninsula, Bahamas, North West Nicaragua, California, the Himalayan Mountains, the Canary Islands, Houston, Dust Storms across the Sahara, and some waves in the South China Seas.

CASI

Conferences; Postflight Analysis; Spacecraft Launching; Magellan Ultraviolet Astronomy Satellite; Spaceborne Astronomy; Liftoff (Launching)

20000029611 NASA Johnson Space Center, Houston, TX USA

STS-99 Crew News Conference

Jan. 21, 2000; In English; Videotape: 36 min. 45 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2000025582; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS

The Shuttle Crew (Mission Commander Kevin R. Kregel, Pilot Dominic L. Pudwill Gorie, Mission Specialists Janet L. Kavandi, Janice E. Voss, Mamoru Mohri, and Gerhard P.J. Thiele) are shown in a live news conference presenting the mission objectives of STS-99. The main objective is to obtain the most complete high-resolution digital topographic database of Earth. This project is named the Shuttle Radar Topography Mission (SRTM).

CASI

Spacecrews; Conferences; Space Shuttle Missions

20000030669 NASA Kennedy Space Center, Cocoa Beach, FL USA

STS-37 Landing

Apr. 11, 1991; In English; Videotape: 45 min. 35 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2000013429; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS

Live footage shows the STS-37 Spacecraft as it re-enters the Earth's atmosphere for a morning landing. The Atlantis spacecraft is seen making a 270-degree turn in its approach attempts to land on runway 33 at Edwards Air Force Base. Also shown are the touchdown of the main and nose gears, and Atlantis' rollout on the runway. The STS-37 crewmembers, Commander Steven R. Nagel, Pilot Kenneth D. Cameron, Mission Specialists Jerry L. Ross, Jay Apt, and Linda M. Godwin, are shown departing the vehicle, posing for photographs, and boarding the Astro-van. Included are also various landing from many different cameras.

CASI

Touchdown; Spacecraft Landing; Approach; Flight Paths; Landing Gear

20000030725 NASA Johnson Space Center, Houston, TX USA

STS-103 Mission Highlights Resource Tape (2 of 2)

Mar. 01, 2000; In English; Videotape: 58 min. 36 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2000036031; JSC-1814; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS

The STS-103 flight crew, Commander Curtis L. Brown, Pilot Scott J. Kelly, Mission Specialists Steven L. Smith, C. Michael Foale, John M. Grunsfeld, Claude Nicollier, and Jean-Francois Clervoy, are seen passing over the Yucatan and Florida Peninsulas. Smith and Grunsfeld replace and change the S-band single transmission cables during the third and final space walk of this mission. Crewmembers are also seen taking video documentation of the solar arrays. Footage presented includes the release of the Hubble Space Telescope, thruster firing and orbit adjust burn over the Central Indian Ocean and Australia. Also shown is the night landing of Discovery at Kennedy Space Center, crew departure from the vehicle, and short statements made by the crew. This is tape 2 of 2; tape 1 has a report number of NONP-NASA-VT-2000036030.

CASI

Space Transportation System; Space Transportation System Flights; Hubble Space Telescope; Maintenance; Checkout; Replacing; Equipment Specifications

20000031349 NASA Kennedy Space Center, Cocoa Beach, FL USA

STS-37/GRO Crew Arrival and TCDT Activities

Mar. 19, 1991; In English; Videotape: 13 min. 32 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2000013431; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS

Live footage shows the night arrival of the T-38 training aircraft. The crewmembers of STS-37, Commander Steven R. Nagel, Pilot Kenneth D. Cameron, Mission Specialists Jerry L. Ross, Jay Apt, and Linda M. Godwin, are seen participating in the Terminal Countdown Demonstration Tests (TCDT). The crew made statements and answer questions from the press. The shuttle is also shown on the pad.

CASI

Astronaut Training; Equipment Specifications; T-38 Aircraft; Crew Procedures (Preflight)

20000031596 NASA Kennedy Space Center, Cocoa Beach, FL USA

STS-99 / Endeavour: Launch Postponement Press Conference

Jan. 31, 2000; In English; Videotape: 20 min. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2000025570; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

Live footage shows Ron Dittemore, the Shuttle Program Manager from Johnson Space Center (JSC), participating in a Launch Postponement Press Conference disclosing the status of the STS-99 flight. He addresses the weather condition which caused the postponement and the erroneous response from one of the Master Events Controllers (MEC). The moderator of this conference is Bruce Buckingham from NASA's Public Affairs Office. Ron answers questions from the audience about the MEC responsible for sending commands for launch, and the implications that it might have on the launch schedule.

CASI

Conferences; Spacecraft Launching; Launch Dates; Delay; Prelaunch Problems; Weather; Spacecraft Reliability; Controllers

20000031615 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-31: APU Controller Removal
Apr. 11, 1990; In English; Videotape: 2 min. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000039787; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS

The launch April 10 of the STS-31 was scrubbed at T-4 minutes due to a faulty valve in auxiliary power unit (APU) number one. The auxiliary power unit is a hydrazine-fueled, turbine-driven power unit that generates mechanical shaft power to drive a hydraulic pump that produces pressure for the orbiter's hydraulic system. This video shows the removal of the STS-31's auxiliary power unit (APU).

CASI
Auxiliary Power Sources; Controllers; Spacecraft Power Supplies; Spacecraft Maintenance; Discovery (Orbiter); Hydraulic Equipment

20000031616 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-31: Hubble Space Telescope Lift to Vertical
Oct. 09, 1989; In English; Videotape: 10 min. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000039777; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS

The footage shows the lifting of the Hubble Space Telescope (HST) to a vertical position in the Kennedy Space Center. HST is a 2.4-meter reflecting telescope that will be deployed in low-Earth orbit (600 kilometers) by the crew of the space shuttle Discovery (STS-31) on 25 April 1990.

CASI
Hubble Space Telescope; Space Shuttle Payloads; Ground Handling; Discovery (Orbiter)

20000031891 NASA Johnson Space Center, Houston, TX USA
STS-101 Crew Training
Mar. 27, 2000; In English; Videotape: 32 min. 4 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000039941; JSC-1824; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS

Live footage shows the crewmembers of STS-101, Commander James D. Halsell Jr., Pilot Scott J. Horowitz, and Mission Specialists Susan J. Helms, Yuri Vladimirovich Usachev, James S. Voss, Mary Ellen Weber, and Jeffrey N. Williams, participating in various crew training. Footage includes the crew Photo Session, crew Compartment Bailout Training, SAFER EVA Virtual Reality Training, ISS Ingress Training, Shuttle Simulator Rendezvous Training, EVA Preparation, and ISS Stowage Training.

CASI
Astronaut Training; Ejection Training; Bailout; Virtual Reality; Spacecraft Cabins; Training Simulators

20000031892 NASA Johnson Space Center, Houston, TX USA
STS-101 Crew Interview / Scott Horowitz
Mar. 20, 2000; In English; Videotape: 38 min. 22 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000039860; JSC-1809B; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS

Live footage of a preflight interview with Pilot Scott J. Horowitz is seen. The interview addresses many different questions including why Horowitz became an astronaut, the events that led to his interest, any role models that he had, and his inspiration. Other interesting information that this one-on-one interview discusses is the reaction and reasons for the splitting-up of the objectives for STS-101 with STS-106. Horowitz also mentions the scheduled space-walk, docking with the International Space Station (ISS), the new glass cockpit of Atlantis, the repairs of equipment and change of the batteries. Horowitz also discusses his responsibilities during the space-walk, and docking of the spacecraft. He stresses that he will have an added challenge during the space-walk, his inability to see where he needs to place the Extravehicular Activities (EVA) crew.

CASI
Crew Procedures (Preflight); Space Transportation System; Space Transportation System Flights

20000031946 NASA Johnson Space Center, Houston, TX USA
STS-101 Crew Interview / Mary Ellen Weber
Mar. 23, 2000; In English; Videotape: 28 min. 28 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000039851; JSC-1809C; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

Live footage of a preflight interview with Mission Specialist Mary Ellen Weber is seen. The interview addresses many different questions including why Weber became an astronaut, the events that led to her interest in chemistry and sky diving. Other interesting information that this one-on-one interview discusses is the reaction and reasons for the change of the mission objectives. Weber also mentions the scheduled space-walk, docking with the International Space Station (ISS), the repairs of equipment and change of the batteries, and the installation of handrails. Weber also discusses her responsibilities during the space-walk, and docking of the spacecraft.
CASI
Crew Procedures (Preflight); Spacecrews

20000032035 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-34 Galileo PCR at Pad & Galileo in Atlantis
Sep. 12, 1989; In English; Videotape: 7 min. 50 sec. playing time, in color, no sound except background noise
Report No.(s): NONP-NASA-VT-2000039781; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS
The primary objective of the STS-34 mission was the deployment of the Galileo spacecraft and the attached Inertial Upper Stage. This videotape shows the Galileo in the Payload Clean Room in preparation for the six year trip to Jupiter. There are also views of the spacecraft in the Atlantis Payload Bay.
CASI
Clean Rooms; Galileo Spacecraft; Space Transportation System

20000032036 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-31 Mission Highlights Resource Tape, Part 1
Jun. 01, 1999; In English; Videotape: 55 min. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000039772; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS
The primary objective of mission STS-31 was to deploy the Hubble Space Telescope. The commander of the mission was Loren J. Shriver. The crew was pilot Charles F. Bolden, and Mission Specialists, Steven A. Hawley, Bruce McCandless II, and Kathryn D. Sullivan. The mission was launched on April 24, 1990. This videotape shows the astronauts at their pre-launch breakfast, their final preparations for launch and boarding the Shuttle Discovery. It shows the launch and the detachment of the rocket boosters. It shows the deployment of the Hubble Telescope and the unfurling of its Solar Arrays. Other payloads include the Protein Crystal Growth (PCG) experiment, and the Radiation Monitoring Equipment III, to measure gamma ray levels in the crew cabin. The videotape shows many shots of the Kennedy Mission Control room and the shuttle cockpit. The videotape finally shows the landing at Edwards Air Force Base, and the crew disembarking the shuttle.
CASI
Hubble Space Telescope; Spacecrews; Space Transportation System; Payload Delivery (STS); Space Shuttle Payloads

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.

20000031753 Institute of Space Medico-Engineering, Beijing, China
Development of a Multi-Channel Physiological Telemetry System
Lei, Jin-yue, Institute of Space Medico-Engineering, China; Chen, Yao, Institute of Space Medico-Engineering, China; Zhang, Xue-kai, Institute of Space Medico-Engineering, China; Wu, Jing, Institute of Space Medico-Engineering, China; Tian, Yun-qin, Institute of Space Medico-Engineering, China; Qiu, Yan-bo, Institute of Space Medico-Engineering, China; Chang, Shao-yong, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; August 1999; ISSN 1002-0837; Volume 12, No. 4, pp. 284-287; In Chinese; Copyright; Avail: Issuing Activity
To develop an instrument used in measurement of physiological parameters in laboratories or field. A computer was used to process data in the telemetry system. The frequency-time division modulation technique was adopted. The low frequency signals were directly connected to the computer serial port after demodulation, and measurement control was achieved by single-chip computer. Temperature measurement results were obtained by conversion table. It is capable of telemeter and processing ECG, wind speed and temperature signals in real-time. Good results were gained in high temperature condition and

- 17 C environment. The instrument has many advantages, such as high accuracy, good processing ability, reliability, long operation distance, small volume and easy operation.
Author
Data Processing; Data Systems; Electrocardiography; Real Time Operation; Reliability; Temperature Measurement; Wind Velocity; Fabrication; Biotelemetry

18
SPACECRAFT DESIGN, TESTING AND PERFORMANCE

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

20000028364 bd Systems, Inc., Huntsville, AL USA
STEP Tether Dynamics Preliminary Analysis ***Final Report***
Glaese, John R., bd Systems, Inc., USA; Feb. 16, 2000; 24p; In English
Contract(s)/Grant(s): NASA Order H-32041-D
Report No.(s): TCD20000075A; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The General Tethered Object Simulation System (GTOSS) has been successfully converted to the PC environment. GTOSS has been run under Microsoft Windows 95, 98 and NT4.0 with no problems noted. Adaptation to the PC environment and definition of the 3 three body configuration required resizing some of the GTOSS internal data arrays. to allow studies of the tether dynamics accompanying electrodynamic thrust, a tether current flow model has also been developed for GTOSS. This model includes effects due to the earth's magnetic field and ionosphere, tether conductivity, temperature, motion, shape and available power. Sample cases have been defined for a proposed STEP-AIRSEDS (Space Transfer using Electrodynamic Propulsion-The Michigan Technic Corporation proposed tether missions for commercial applications) three body configuration. This required definition of a 6th power scenario for GTOSS. This power scenario allows a user to specify whether orbit raising or orbit lowering is to be performed by selecting the number of the tether. Orbit raising and orbit lowering sample cases have been run successfully. Results from these runs have been included in this report. Results have only been generated so far for a three body configuration. Only point end masses have been represented. No attitude dynamics have been included. Initial results suggest that tether current can have significant and detrimental effects on tether dynamics and provisions will have to be made for control of it. This control will have to be considered in connection with desired target orbits for electrodynamic thrusting, as well as end body attitude control, momentum management of proposed control moment gyros, solar array pointing. All of these items will interact and thus, any system simulation will have to have each of these effects modeled in sufficient detail to display these interactions.
Derived from text
Computerized Simulation; Tethering; Electrodynamics; Spacecraft Configurations; Electric Propulsion

20000031364 NASA Langley Research Center, Hampton, VA USA
A Multidisciplinary Performance Analysis of a Lifting-Body Single-Stage-to-Orbit Vehicle
Tartabini, Paul V., NASA Langley Research Center, USA; Lepsch, Roger A., NASA Langley Research Center, USA; Korte, J. J., NASA Langley Research Center, USA; Wurster, Kathryn E., NASA Langley Research Center, USA; 2000; 14p; 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 2000-1045; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Lockheed Martin Skunk Works (LMSW) is currently developing a single-stage-to-orbit reusable launch vehicle called VentureStar(TM) A team at NASA Langley Research Center participated with LMSW in the screening and evaluation of a number of early VentureStar(TM) configurations. The performance analyses that supported these initial studies were conducted to assess the effect of a lifting body shape, linear aerospike engine and metallic thermal protection system (TPS) on the weight and performance of the vehicle. These performance studies were performed in a multidisciplinary fashion that indirectly linked the trajectory optimization with weight estimation and aerothermal analysis tools. This approach was necessary to develop optimized ascent and entry trajectories that met all vehicle design constraints. Significant improvements in ascent performance were achieved when the vehicle flew a lifting trajectory and varied the engine mixture ratio during flight. Also, a considerable reduction in empty weight was possible by adjusting the total oxidizer-to-fuel and liftoff thrust-to-weight ratios. However, the optimal ascent flight profile had to be altered to ensure that the vehicle could be trimmed in pitch using only the flow diverting capability of the

aerospike engine. Likewise, the optimal entry trajectory had to be tailored to meet TPS heating rate and transition constraints while satisfying a crossrange requirement.
Author
Multidisciplinary Design Optimization; Lifting Bodies; Single Stage to Orbit Vehicles; Design Analysis

20000031642 Aerospace Corp., Technology Operations, El Segundo, CA USA
An Internal Charging Environmental Specification for Geosynchronous and HEO/Molniya Satellites
Fennell, J. F.; Koons, H. C.; Blake, J. B.; Sep. 30, 1999; 14p; In English
Contract(s)/Grant(s): F04701-93-C-0094
Report No.(s): AD-A373467; TR-99(8570)-12; SMC-TR-00-04; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Internal charging has been indicated as the cause of many satellite anomalies. In some cases, it has been argued that internal charging has caused satellite system failures. An internal charging environment specification is needed by satellite manufacturers for setting design requirements. A specification is also required for providing energetic electron flux levels and total fluence levels for electron beam testing to verify that critical systems are immune to internal charging, for performing tests on subsystems, and for use in anomaly investigation programs. We present preliminary internal charging environment specifications that have been developed for some commonly used orbits such as geosynchronous and Molniya or high Earth orbits (HEO) and show what they predict as shielding requirements to reduce worst case electron fluxes to safe levels.
DTIC
Earth Orbits; Synchronous Satellites; Trajectories; System Failures; Molniya Satellites; Radiation Damage

20000031685 Cornell Univ., Ithaca, NY USA
Satellite Attitude Control Using Magnetic Torquers, a Periodic Time-Varying Control Problem ***Final Report, 1 Mar.-31 Oct. 1999***
Psiaki, Mark L.; D'Andrea, Raffaello; Jan. 26, 2000; 25p; In English
Contract(s)/Grant(s): F49620-99-1-0169; AF Proj. 2304
Report No.(s): AD-A373391; AFRL-SR-BL-TR-00-0021; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Satellite attitude controllers have been designed for a rigid spacecraft whose only actuators are magnetic torque rods. This effort's goals have been to develop a new class of lightweight, moderate accuracy attitude controllers and to evaluate and further develop general methods for the control of time varying systems. Three different classes of controllers have been developed and simulation tested. one based on linear quadratic regulator techniques, one based on sliding mode like concepts, and one based on new H infinity techniques for time varying systems. These H infinity controllers achieve the best performance. In addition to the controller design studies. the issue of attenuation of constant 3 axis disturbances has been addressed. Disturbance attenuation is difficult for this system because it can apply torques only about the 2 axes that are perpendicular to the Earth's magnetic field. It is a challenge to determine how best to counteract a low frequency 3 axis disturbance torque, on average, via judicious use of the fact that the Earth's magnetic field direction varies in time as the spacecraft moves along its orbit. Pointing accuracies on the order of 1 deg or better have been demonstrated in the presence of typical levels of disturbance torque.
DTIC
Space Navigation; Satellite Attitude Control; Torquers; Actuators; Controllers; Control Systems Design

20000031894 Saint Mary's Univ., San Antonio, TX USA
Variability Reduction and Design of Experiments Techniques for Improving System Performance of the International Space Station Kit for External Repair of Module Impacts
Chaudhary, Ravi I.; Moras, Rafael; Hall, Stephen; Bohl, William; Feb. 2000; 7p; In English
Report No.(s): AD-A373716; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

The Kit for Repair of Module Impacts, or KERMIt, is designed to provide astronauts with a patch kit to seal damaged International Space Station (ISS) modules. The patch is applied externally and requires Extravehicular Activity, or space walks, in order to install the patch. The installation procedure is crew intensive and requires injection of an adhesive to form a lasting environmental seal, restoring atmospheric conditions inside the module. A five%step analysis of the KERMIt program revealed two critical processes which, when controlled, provided measurable performance gains in the KERMIt system. Adhesive injection and flow was the first critical process, requiring design of experiments and variability reduction techniques to reduce variability in adhesive flow and formation. Analysis of KERMIt crew installation procedures required refinement of experimental methods

in order to determine areas for improvement. Verification testing validated both control techniques, demonstrating the effectiveness of variability reduction and design of experiments to improve KERMIt system performance.
DTIC
Variability; Experiment Design; International Space Station; Control Systems Design; Spacecraft Maintenance

20000031949 Aerospace Corp., Technology Operations, El Segundo, CA USA
Initial Analysis of NAVSTAR Vehicle 38 Calorimeter Test Data
Arnold, G. S.; Uht, J. C.; Hall, D. G.; Jul. 01, 1999; 15p; In English
Contract(s)/Grant(s): F04701-93-C-0094
Report No.(s): AD-A373657; TR-99(1590)-1; SMC-TR-00-03; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report presents an analysis of the first three months of calorimeter data from the NAVSTAR vehicle 38 solar array contamination flight test. The conclusion of this preliminary analysis is that the calorimeters' solar absorptances are increasing at a rate of several percent (absolute value) per year. These values are consistent with the observed approx. 2% per year anomalous solar array power loss.
DTIC
Global Positioning System; Artificial Satellites; Solar Arrays; Navstar Satellites; Calorimeters

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.

20000031723 NASA Goddard Space Flight Center, Greenbelt, MD USA
MEMS Rate Sensors for Space
Gambino, Joel, NASA Goddard Space Flight Center, USA; [2000]; 8p; In English; 23rd; 23rd Annual Guidance and Control Conference, 2-6 Feb. 2000, Breckenridge, CO, USA; Sponsored by American Astronautical Society, USA
Report No.(s): AAS-00-062; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Micromachined Electro Mechanical System (MEMS) Rate Sensors are an enabling technology for Nanosatellites. The recent award of a Nanosatellite program to the Goddard Space Flight Center (GSFC) underscores the urgency of the development of these systems for space use. The Guidance Navigation and Control Center (GNCC) at the GSFC is involved in several efforts to develop this technology. The GNCC seeks to improve the performance of these sensors and develop flight ready systems for spacecraft use by partnering with industry leaders in MEMS Rate Sensor development. This paper introduces Microgyros and discusses the efforts in progress at the GNCC to improve the performance of these units and develop MEMS Rate Sensors for space use.
Author
Microelectromechanical Systems; Sensors; Rates (Per Time); Nanosatellites; Space Flight; Inertial Guidance

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.

20000031654 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; 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 2000-1044; 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 iSIGHTI 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; Rocket Engine Design; Design Analysis

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.

20000027693 Conservation of Clean Air and Water-Europe, Brussels Belgium
Petroleum Waxes and Related Products
1999; 42p
Report No.(s): PB2000-103161; CONCAWE-99/110; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

The dossier summarizes the physical and chemical properties and toxicological, health, safety and environmental information available on waxes and related products. These include the slack waxes, petroleum waxes and petrolatum.
NTIS
Waxes; Crude Oil

20000030730 International Wire and Cable Symposium, Inc., Eatontown, NJ USA
Proceedings of the 48th International Wire and Cable Symposium
Nov. 18, 1999; 908p; In English; 48th, 15-18 Nov. 1999, Atlantic City, NJ, USA
Report No.(s): AD-A373457; No Copyright; Avail: CASI; A10, Microfiche; A99, Hardcopy

The International Wire and Cable Symposium provides a forum for the exchange of technical information amongst suppliers, manufacturers, and users on technological advancements in materials, processes, and products used for voice, data and video signal transmission systems.
DTIC
Conferences; Wire; Coaxial Cables; Fiber Optics; Transmission Lines; Flame Retardants

20000031320 National Chemicals Inspectorate, Solna, Sweden
Phase-Out of PBDEs and PBBs: Report on a Governmental Commission
1999; ISSN 0284-1185; 66p; In English
Report No.(s): PB2000-103185; KEMI-2-99; Copyright; Avail: National Technical Information Service (NTIS)

Contents include the following: Summary; Introduction; Description of the Present Situation; Dispersal of PBDEs and PBBs in the Society; Risks of PBDEs and PBBs; Alternatives; Discussion; Conclusions and Proposals; Consequences; Glossary; and References.
NTIS
Polybrominated Biphenyls; Ethers

20000031387 Department of the Navy, Washington, DC USA
System and Method for the Remote Detection of Organic Material in Ice in Situ
Longacre, Jacob R., Inventor; Jul. 20, 1999; 5p; In English
Patent Info.: Filed 14 Oct. 97,; US-Patent-Appl-SN-08-954-092; US-Patent-5,926,270
Report No.(s): AD-D019591; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A system for remotely detecting organic material in a volume, such as an ice layer, in situ, includes a light source, an optical receiver and a control subsystem. The light source generates a laser light beam and directs the generated laser beam at the volume. If organic material is present in the volume, the optical receiver detects fluorescent light components from the volume generated

by the organic material in response to the laser light beam generated by the light source. The control subsystem controls the operations of the light source and the optical receiver.
DTIC
Remote Sensing; Detection; Organic Materials; Ice

20000031388 Department of the Navy, Washington, DC USA
Phthalonitrile Thermoset Polymers and Composites Cured With Halogen-Containing Aromatic Amine Curing Agents
Sastri, Satya B., Inventor; Keller, Teddy M., Inventor; Jul. 20, 1999; 7p; In English
Patent Info.: Filed 2 Oct. 97,; US-Patent-Appl-SN-08-940-036; US-Patent-5,925,475
Report No.(s): AD-D019592; No Copyright; Avail: US Patent and Trademark Office, Microfiche

Phthalonitrile thermoset polymers and Composites having flame resistance are formed by combining a phthalonitrile monomer in the melt stage with a halogen-containing aromatic amine curing agent. The halogen-containing aromatic amine curing agent is selected from the group consisting of aromatic amine curing agents having the general formula: NH.-(Ar'O), Ar1-X-Ar1(-OAr1)-NH2, wherein Ar1 and Ar2 are substituted or unsubstituteil aromatic groups, y is O or greater, and X is -C(CF3)2- and aromatic amine curing agents having the general formula: NH2-(Ar1O), Ar-Z-Ar3(-OAr1)u-NH2 wherein Z is a connecting bond or a linking group other than, oxygen or C(CF3)2- , u is O or greater and Ar3 and Ar2 are aromatic groups and wherein either Ar3 or Ar1 or both Ar3 and Ar1 are substituted with at least one halogen atom or halo-substituted alkyl group.
DTIC
Amino Radical; Phthalates; Thermosetting Resins

20000031714 Department of the Navy, Washington, DC USA
Fluoroaliphatic Cyanate Resins for Low Dielectric Applications
Snow, Arthur W., Inventor; Buckley, Leonard J., Inventor; Jul. 27, 1999; 10p; In English; Supersedes US-Patent-Appl-SN-09/006448
Patent Info.: Filed 13 Jan. 1998; US-Patent-Appl-SN-006,448; US-Patent-5,929,199
Report No.(s): AD-D019521; No Copyright; Avail: US Patent and Trademark Office, Microfiche

The present invention is a cyanate resin monomer having the formula: NCO-CH2-(CF2)n-CH2-OCN where n is an even integer from 6 to 10, inclusive. Another aspect of the invention is an essentially pure cyanate resin monomer having the formula: NCO-CH2-(CF2)n-CH2-OCN where n=3, 4, 6, 5, or 10. Another aspect of the invention is a prepolymer made by the process of heating a monomer of the invention to a conversion below the gel point. Another aspect of the invention is a method for deposition an interlevel dielectric resin on an integrated circuit, having the steps: (a) coating the integrated circuit with a thin film of a prepolymer made by the process of heating a monomer of the invention to below the gel point, and (b) curing the prepolymer to at least the gel point. Another aspect of the invention is a low dielectric thermoset polymer resin made from these monomers. Another aspect of the invention is a composite of a resin of the invention combined with another material or materials, for structural and/or electronic applications. Such materials include powders and fibers made from, e.g., fused silica or quartz. Another aspect of the invention is making and purifying the monomers of the invention.
DTIC
Dielectrics; Aliphatic Compounds; Patents; Powder (Particles); Curing

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COMPOSITE MATERIALS

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

20000030652 NASA Glenn Research Center, Cleveland, OH USA
Cyclic Oxidation of FeCrAlY/Al2O3 Composites
Nesbitt, James A., NASA Glenn Research Center, USA; Draper, Susan L., NASA Glenn Research Center, USA; Barrett, Charles A., NASA Glenn Research Center, USA; 1999; 19p; In English
Contract(s)/Grant(s): RTOP 523-31-13; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Three-ply FeCrAlY/Al2O3 composites and FeCrAlY matrix-only samples were cyclically oxidized at 1000 C and 1100 C for up to 1000 1-hr cycles. Fiber ends were exposed at the ends of the composite samples. Following cyclic oxidation, cracks running parallel to and perpendicular to the fibers were observed on the large surface of the composite. In addition, there was evidence of increased scale damage and spallation around the exposed fiber ends, particularly around the middle ply fibers. This damage was more pronounced at the higher temperature. The exposed fiber ends showed cracking between fibers in the outer plies,

occasionally with Fe and Cr-rich oxides growing out of the cracks. Large gaps developed at the fiber/matrix interface around many of the fibers, especially those in the outer plies. Oxygen penetrated many of these gaps resulting in significant oxide formation at the fiber/matrix interface far within the composite sample. Around several fibers, the matrix was also internally oxidized showing Al2O3 precipitates in a radial band around the fibers. The results show that these composites have poor cyclic oxidation resistance due to the CTE mismatch and inadequate fiber/matrix bond strength at temperatures of 1000 C and above.
Author
Oxidation Resistance; Aluminum Oxides; Cycles; Fiber-Matrix Interfaces; Fracture Strength; Matrix Materials

20000030716 Department of the Navy, Washington, DC USA
Ceramic Polymer Composite Dielectric Material
Lee, John D., Inventor; Lee, Gilbert F., Inventor; Hartmann, Bruce T., Inventor; Wendt, Harold C., Inventor; Richardson, John J., Jr., Inventor; Jul. 13, 1999; 5p; In English; Supersedes , AD-D019556.
Patent Info.: Filed 6 Jun. 99,; US-Patent-Appl-SN-09-225-676; US-Patent-5-922,435A
Report No.(s): AD-D019600; No Copyright; Avail: US Patent and Trademark Office, Microfiche
This patent discloses a shock resistant dielectric material comprising TiO2 particles dispersed in a matrix material which is: (1) the polyurea reaction product of a poly(tetramethylene ether)glycol-di-p-aminobenzoate prepolymer and an aromatic diisocyanate or (2) a blend of the polyurea reaction product and a cyanate ester homopolymer of bis(4-cyanatophenyl)-1,1-ethane.
DTIC
Patents; Ceramics; Composite Materials

20000031334 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
Mechanical and Ballistic Properties of Composites of Polypyrrole-Coated S-2 Glass Fabrics ***Final Report, Jan. 1994-Apr. 1999***
Spurgeon, William A.; Klinger, J. R.; Roylance, Margaret E.; Oct. 1999; 57p; In English
Contract(s)/Grant(s): Proj-62218AH80
Report No.(s): AD-A373510; ARL-TR-2105; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
This report presents the results of mechanical and ballistic tests on polyester and polyurethane-based composites of polypyrrole-coated 5-2 glass fabrics. The fabrics were obtained from the Milliken Research Corporation, Spartanburg, SC. The data support the proposition that the glass fibers are, at most, slightly damaged by the coating process that requires an acidic solution of pH 1. The mechanical properties of the interface between the glass fibers and the matrix resin are weakened by the presence of the polypyrrole coating in the polyester resin composites. As a consequence, the tensile, compressive, flexure, and short-beam-shear strengths are all lower than comparable composites made with uncoated fabrics. The ballistic properties of the polypyrrole-coated-fabric polyester resin composites are as good or perhaps even slightly better, however, as a result of increased delamination. The tensile strengths of the polypyrrole-coated-fabric polyurethane composites were slightly higher than for similar composites made with uncoated fabrics, although the flexural modulus was not changed. The tensile strength of the polypyrrole-coated fabrics was also measured and found to be about 20% higher than comparable amino-silane-sized fabrics, apparently as a consequence of the increased lubricity of the polypyrrole-coated fibers.
DTIC
Fabrics; Pyrroles; Polyurethane Resins; Ballistics; Mechanical Properties; Ceramic Matrix Composites; Glass Fibers; Coatings; Polyester Resins

20000031337 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
Co-Injection Resin Transfer Molding of Vinyl-Ester and Phenolic Composites ***Final Report, Jan. 1996-Dec. 1997***
Fink, Bruce K.; Gillio, Emanuele F.; McKnight, Geoffrey P.; Gillespie, John W., Jr.; Advani, Suresh G.; Jan. 2000; 37p; In English; Prepared in collaboration with Delaware Univ., Newark, DE.
Report No.(s): AD-A373528; ARL-TR-2150; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Vacuum-assisted resin transfer molding (VARTM)-type processes have been proven cost-effective manufacturing techniques for large composite structures. However, their use has been limited to a single resin system. Many composite structures require multiple resins to serve different purposes while being integrated into a single structure. Co-injection resin transfer molding (CIRTM) is a new manufacturing process developed by the U.S. Army Research Laboratory (ARL) with the University of Delaware that enables the user to manufacture multilayer hybrid composite parts in a single processing step. In this report, CIRTM is used to manufacture a dual-layered structure consisting of a vinyl-ester layer for structural integrity and a phenolic layer for fire, smoke, and toxicity protection. The two resins are simultaneously injected into a mold filled with a stationary fiber bed and are co-cured. Resin separation is maintained by a 1-mil-thick polysulfone film sandwiched between two layers of 6.5-mil-thick

adhesive. A differential scanning calorimeter (DSC) is used to select the optimum cure cycle for all of the materials. Mechanical testing is used to evaluate the performance of the interphase formed between dissimilar materials. Experimental results show that co-injected, co-cured materials offer equivalent properties or, in some cases, more superior properties, than those provided by single-injection resin composites. This case is used to develop and present a methodology that can be followed to co-inject different resins.
DTIC
Resin Transfer Molding; Injection Molding; Composite Structures; Hybrid Composites

20000031339 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
Measurement of Viscosity of Reacting Vinyl-Ester Resins Using Direct-Current Sensing ***Final Report, Jan. 1996-Mar. 1998***
Fink, Bruce K.; England, Kenric M.; Gillespie, John W., Jr; Jan. 2000; 45p; In English; Prepared in collaboration with Delaware Univ., Newark, DE.
Report No.(s): AD-A373539; ARL-TR-2149; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This study investigated the sensing of viscosity an gelation of reacting vinyl-ester (VE) resins using direct-current (DC) sensing technology. The resin system studied was a tetrabutylammonium acetate (TA)-doped Dow Derakane 411-C-50 VE resin. A model of the resistance of a reacting polymer liquid as a function of the geometrical parameters of the DC-sensing system and the material properties of the resin system was developed. The model inputs were conduction path length (L), conductor surface area (A), resin viscosity (eta(t)), concentration of TA ions (Ci), charge of TA ions (Qi), and size of TA ions. Estimates, using the theoretically determined values for the model inputs, for the resistance of the DC sensing system employed in this investigation were the same order of magnitude as the experimentally determined values. The developed model of a reacting polymer liquid was furtber extended to the sensing of gelation and then successfully applied to the on-line sensing of viscosity.
DTIC
Composite Materials; Viscosity; Doped Crystals; Esters; Resins; Direct Current

20000031887 Department of the Navy, Washington, DC USA
Ceramic Polymer Composite Dielectric Material
Lee, John D., Inventor; Lee, Gilbert F., Inventor; Hartmann, Bruce T., Inventor; Wendt, Harold C., Inventor; Richardson, John J., Jr, Inventor; Aug. 10, 1999; 6p; In English
Patent Info.: Filed 6 Mar. 97,; US-Patent-Appl-SN-08,812,153; US-Patent-5,936,025
Report No.(s): AD-D019556; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A shock resistant dielectric material comprising TiO2 particles dispensed in a matrix material which is (1) the polyurea reaction product of a poly(tetramethylene ether)glycol-di-p- aminobenzoate prepolymer and an aromatic diisocyanate or (2) a blend of the polyurea reaction product and a cyanate ester homopolymer of bis(4-cyanatophenyl)-1,1-ethane.
DTIC
Ceramic Matrix Composites; Dielectrics; Patents; Composite Materials

20000031888 Ioffe (A. F.) Physical-Technical Inst., Saint Petersburg, Russia
Electron Transport and Charge Memory Effects in Metal-Dielectric Nanocomposites ***Final Report, 24 Jul. 1998 - 24 Jul. 1999***
Gurevich, S. A.; Zakheim, D. A.; Rozhansky, I. V.; Zabelin, V. A.; Scopina, V. I.; Oct. 1999; 28p; In English
Contract(s)/Grant(s): N68171-98-M-5654
Report No.(s): AD-A372482; R/D-8367-EE-01; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this work is to study the mesoscopic limits of conductivity in granulated materials like metal-dielectric nanocomposites and to reveal the major design features of mesoscopic transistor (and charge memory device) made of these materials. Thin composite Cu:SiO2 films containing 2-3 nm Cu granules were fabricated and temperature dependencies of conductivity were measured (in dielectric regime) as function of Cu content and the sample size The experimental results are analyzed using newly developed numerical model of conductivity which deals with the network of tunneling resistance between randomly arranged small metallic balls, accounts for Coulomb interaction between charged balls, and essentially incorporates screening effects. It is found that the experimental conductivity of all the samples follows the universal ”1/square root T” law at low temperatures (Tis less than 100K) which is treated as the manifestation of Coulomb gap in the density of states of composite material. Both simulations and experiment show that the mesoscopic limit of the composite sample size is about 20-30 nm at T

approx. 300K (and approx. 50 nm at 30K). We argue that with such small samples it should be possible to implement the room temperature single-electron transistor device by applying the electric field perpendicular to the current chain.
DTIC
Composite Materials; Electron Transfer; Charge Coupled Devices; Electric Fields; Dielectrics

20000032028 Defence Science and Technology Organisation, Melbourne Australia
Hot/Wet Environmental Degradation of Honeycomb Sandwich Structure Representative of F/A-18: Flatwise Tension Strength
Radtke, T. C.; Charon, A.; Vodicka, R.; Sep. 1999; 40p; In English
Report No.(s): AD-A373702; DSTO-TR-0908; DODA-AR-011-146; No Copyright; Avail: Defense Technical Information Center (DTIC)

Aluminium honeycomb structure is widely used in the F/A-18 to save weight, however it is susceptible to degradation by water. The US Navy has experienced in-flight failures of honeycomb components such as the rudder which are believed to be due to moisture induced degradation. A long-term (52 week) environmental exposure trial was conducted to determine the effects on the flatwise tension (FWT) strength of honeycomb sandwich structure. A conditioning temperature of 70 C was chosen coupled with high-humidity exposure (85% and 95% R.H) to simulate a worst case hot/wet environment The trial simulated specimens in which moisture could freely enter the core (direct ingress) and those which were fully sealed and allowed only moisture diffusion through the epoxy matrix of the skins (diffusion ingress). The FWT strength was measured at 4, 9, 16, 32 and 52 weeks exposure. The FWT values decreased by about 40-50% when tested at 104 C and about 25% when tested at room temperature after exposure periods greater than 16 weeks. Both the direct ingress and diffusion ingress samples showed similar FWT strength losses but markedly different modes of failure. Diffusion specimens failed cohesively in all cases while the direct ingress samples failed predominantly adhesively after an exposure time of about 9 weeks. Subsequent drying of the samples exposed to the conditioning environment showed that diffusion ingress samples recovered most of their original FWT strength but direct ingress samples recovered only about 70% of their original baseline strength. This work shows that excluding water from within honeycomb sandwich structures is of primary importance in order to prevent permanent bond degradation and corrosion of the core.
DTIC
Degradation; Sandwich Structures; Honeycomb Cores

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INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

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

20000027674 California Univ., Dept. of Applied Mechanics and Engineering Services, San Diego, CA USA
Inhibition of Non-Premixed Hydrogen Flames by CF3Br
Truett, Leonard, California Univ., USA; Thermann, Hans, California Univ., USA; Trees, Dietmar, California Univ., USA; Seshadri, Kal, California Univ., USA; Yuan, Jessie, University of North Texas, USA; Wells, Leah, University of North Texas, USA; Marshall, Paul, University of North Texas, USA; 1998, pp. 2741-3748; In English; 27th; Combustion, 1998, USA; Sponsored in part by the Robert A. Welch Foundation and the UNT Faculty Research Fund
Contract(s)/Grant(s): DAAH-95-I-0106; B-1174
Report No.(s): AD-A369986; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

Experimental and numerical studies are performed to elucidate the fundamental chemical mechanisms by which CF3Br inhibits non-premixed hydrogen flames. These studies are motivated by previous work which shows that CF3Br and its decomposition products inhibit hydrocarbon flames primarily by reacting directly with the radicals and by depleting radicals in the region where hydrogen and Carbon monoxide are oxidized to form water and carbon dioxide. The elementary reaction CF3Br + H = CF3 + HBr plays a prominent role in flame inhibition but there are considerable uncertainties in the value of the rate parameters for this reaction. In view of these uncertainties the rate of this reaction is measured directly by employing the flash-photolysis resonance fluorescence (FP-RF) technique and is compared with that predicted using transition state theory based on ab initio calculations. Predicted and measured rate parameters agree well but differ significantly from those used in previous studies. The improved rate parameters are tested by conducting numerical computations and experiments on flames stabilized between two counterflowing streams. The fuel stream is a mixture of hydrogen and nitrogen and the oxidizing stream of air and

CF3Br. The strain rate at extinction is measured and given as a function of the concentration of CF3Br in the oxidizing stream. Numerical calculations are performed at conditions identical to those used in the experiments using detailed chemistry. Two different chemical kinetic mechanisms are used. The chemical kinetic mechanism describing the oxidation of the fuel is the same in both mechanisms but the inhibition chemistries are different. One of the mechanism has not been tested before on non-premixed flames. One mechanism is found to generally overpredict and the other to underpredict the inhibiting effect of CF3Br. The degree of overprediction and underprediction is evaluated using asymptotic theory. The differences between the mechanisms are discussed.
Author
Flames; Carbon Compounds; Combustion Chemistry; Oxidation

20000028400 Tsentralni Aerogidrodinamicheskii Inst., Zhukovsky, Russia
Experimental Investigation of Supersonic Combustion of Liquid Hydrocarbon Fuel Using Barbotage in the Aeroramp Configuration at M = 2.5 ***Final Report***
Sabel'nikov, Vladimir; Dec. 10, 1999; 51p; In English
Contract(s)/Grant(s): F61775-99-W-E050
Report No.(s): AD-A373147; EOARD-SPC99-4050; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
Results of investigations of combustion of liquid hydrocarbon fuel jets aerated by air in a supersonic flow in the two-dimensional diverging-area supersonic combustor are presented. Direct-connect combustor tests were conducted at the combustor entrance Mach number M=2.5 and total temperature in the range of Tt = 1635-1742K. The liquid hydrocarbon fuel supply into the combustor was executed through the modified (in comparison with the baseline) aeroramp configurations:1) installation of baseline aeroramps at the upper and bottom walls of the combustor, 2) combined fuel feed through injector nozzles of aeroramps separately of air and of fuel aerated by air, 3) injectors with the different from baseline aeroramps angles of fuel injection and geometry nozzles. The results obtained with the modified aeroramp configurations are superior to earlier ones obtained with baseline aeroramp configuration.
DTIC
Supersonic Combustion; Liquid Fuels; Hydrocarbon Combustion; Hydrocarbon Fuels

20000028406 California Univ., San Diego, Dept. of Applied Mechanics and Engineering Services, La Jolla, CA USA
Rate-Ratio Asymptotic Analysis of Inhibition of Nonpremixed Methane-Air Flames by CF3Br
Grudno, A., California Univ., San Diego, USA; Seshadri, K., California Univ., San Diego, USA; Combustion and Flame; 1998; ISSN 0010-2180; Volume 112, pp. 418-437; In English
Report No.(s): AD-A369975; Copyright; Avail: Issuing Activity, Microfiche, Hardcopy
Rate-ratio asymptotic analysis is performed using a reduced four-step chemical-kinetic mechanism to elucidate the influence of CF3Br on the structure of nonpremixed methane-air flames. The inhibitor CF3Br is added to the oxidizer stream of the nonpremixed flame. The primary focus of the analysis is to obtain the critical conditions of extinction. The asymptotic flame structure is constructed using the results of numerical calculations performed using a detailed chemical-kinetic mechanism made up of elementary reactions. The strain rate and the scalar dissipation rate represents the characteristic residence times in the reaction zone. For very small values of the strain rate and the scalar dissipation rate, the fuel CH3 and the inhibitor CF3Br are presumed to be consumed in different regions of the flame. The nondimensional distance between these regions is of the order of unity. At conditions close to extinction these regions merge and this merged reaction zone is analyzed. In the merged reaction zone chemical reactions are presumed to take place in three layers which are called the fuel-consumption layer, the oxidation layer and the CF3Br-consumption layer. The fuel is consumed in the fuel-consumption layer and the inhibitor in the CF3Br-consumption layer. The elementary reaction H + Br2 yields HBr + Br plays a central role in the inhibition of the chemical reactions taking place in the flame. This reaction increases the rates by which radicals recombine in the oxidation layer. The results of the asymptotic analysis show that at fixed values of the scalar dissipation rate, with increasing concentrations of CF3Br in the oxidizer stream the maximum temperature in the reaction zone increases, and the amount of oxygen leaking through the reaction zone increases. Also the scalar dissipation rates at extinction decrease with increasing concentrations of CF3Br in the oxidizer stream. The qualitative aspects of the changes in the values of the scalar dissipation rate at extinction with increasing concentrations of CF3Br agree well with numerical results obtained using a detailed chemical-kinetic mechanism and with experimental data.
Author
Chemical Reactions; Fuel Consumption; Inhibitors; Oxidation; Reaction Kinetics; Burning Rate

20000028411 National Inst. of Standards and Technology, Gaithersburg, MD USA

Experimental Thermal Conductivity Values for Mixtures of R32, R125, R134a, and Propane ***Final Report***

Perkins, R. A.; Schwarzberg, E.; Gao, X.; Dec. 1999; 202p; In English

Report No.(s): PB2000-102845; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

No abstract available.

NTIS

Thermal Conductivity; Mixtures

20000029420 Talley Defense Systems, Mesa, AZ USA

Burning Rate Augmentation at High Acceleration Levels

Davis, Frank E., Talley Defense Systems, USA; Bowman, N. F., Talley Defense Systems, USA; Glick, Robert L., Talley Defense Systems, USA; JANNAF 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 269-276; In English; See also 20000029419

Contract(s)/Grant(s): DAAA21-94-C-0078; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Rearrangement of the Greatrix/Gottlieb acceleration augmentation model is shown to predict acceleration augmentation for ALL members of a fixed chemical composition family using data from a single family member. Correlation is demonstrated with an HTPB/AP propellant at high (rocket motor) and low (base burner) pressure levels using Broddner's CTPB/AP high pressure data and Kayser's HTPB/AP low pressure data. An improved base burner model is briefly described and motor/base burner data are compared with predictions based on the acceleration augmentation correlation. A bi-stable fluid dynamic phenomenon associated with base burner efflux is shown.

Author

Burning Rate; High Acceleration; Solid Propellant Combustion; Deflagration; Metal Combustion; Augmentation

20000029421 Sandia National Labs., Combustion Research Facility, Livermore, CA USA

Influence of Pressure-Driven Gas Permeation on the Quasi-Steady Burning of Porous Energetic Materials

Margolis, Stephen B., Sandia National Labs., USA; JANNAF 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 277-291; In English; See also 20000029419

Contract(s)/Grant(s): DE-AC04-94AL-85000; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

A theoretical two-phase-flow analysis is developed to describe the quasi-steady propagation, across a pressure jump, of a multi-phase deflagration in confined porous energetic materials. The difference, or overpressure, between the upstream (unburned) and downstream (burned) gas pressure leads to a more complex structure than that which is obtained for an unconfined deflagration in which the pressure across the multi-phase flame region is approximately constant. In particular, the structure of such a wave is shown by asymptotic methods to consist of a thin boundary layer characterized by gas permeation into the unburned solid, followed by a liquid/gas flame region, common to both types of problems, in which the melted material is preheated further and ultimately converted to gaseous products. The effect of gas flow relative to the condensed material is shown to be significant, both in the porous unburned solid as well as in the exothermic liquid/gas melt layer, and is, in turn, strongly affected by the overpressure. Indeed, all quantities of interest, including the burned temperature, gas velocity and the propagation speed, depend on this pressure difference, leading to a significant enhancement of the burning rate with increasing overpressure. In the limit that the overpressure becomes small, the pressure gradient is insufficient to drive gas produced in the reaction zone in the upstream direction, and all gas flow relative to the condensed material is directed in the downstream direction, as in the case of an unconfined deflagration. The present analysis is particularly applicable to those types of porous energetic solids, such as degraded nitramine propellants, that can experience significant gas flow in the solid preheat region and which are characterized by the presence of exothermic reactions in a bubbling melt layer at their surfaces.

Author

Burning Rate; Propellant Combustion; Two Phase Flow; Porous Materials; Gas Pressure; Asymptotic Methods; Deflagration; Pressure Effects; Propellants

20000029422 Alabama Univ., Huntsville, AL USA

Uncertainty Assessment of Ultrasonic Measurement of Propellant Burning Rate

Dauch, F., Alabama Univ., USA; Moser, Marlow D., Alabama Univ., USA; Frederick, Robert A., Jr., Alabama Univ., USA; Coleman, H. W., Alabama Univ., USA; JANNAF 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 293-304; In English; See also 20000029419

Contract(s)/Grant(s): N00014-95-1-1338; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

The ultrasonic measurement of propellant burning rate measurement in a closed pressure vessel has been successfully used for a number of years. This technique is desirable because the complete burning rate curve can be obtained over a wide range of pressures in a single test. However, the uncertainty associated with the measurement has not been well characterized. The algorithm to reduce the data has been examined and modified to determine the accuracy of the results. The measured quantities are pressure, initial propellant thickness, and the ultrasonic wave propagation time. The uncertainty in the instantaneous thickness of the propellant has been determined and the effects of correlation between the uncertainties in the measured variables are discussed. The uncertainty in the burning rate of the propellant has been computed using Monte Carlo simulations and it was found that the uncertainty is ranging from 3 to 6%. It was determined that the uncertainty changes considerably during the test (especially for the instantaneous thickness) and was test dependent.

Author

Burning Rate; Pressure Vessels; Propellant Combustion; Ultrasonics; Measurement; Propellant Properties; Erosive Burning

20000029423 Pennsylvania State Univ., Dept. of Mechanical and Nuclear Engineering, University Park, PA USA

Characterization of Combustion Behavior of TAL-1308 Solid Propellant

Risha, Grant A., Pennsylvania State Univ., USA; Ulas, Abdullah, Pennsylvania State Univ., USA; Kuo, Kenneth K., Pennsylvania State Univ., USA; Koch, Donald E., Pennsylvania State Univ., USA; Ludwig, Christopher P., Talley Defense Systems, USA; Glick, Robert, Talley Defense Systems, USA; JANNAF 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 305-319; In English; See also 20000029419; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

An experimental investigation on the characterization of the combustion behavior of a composite solid-propellant airbag formulation, TAL-1308, has been conducted. The major objective of this study was to experimentally determine several combustion characteristics of the TAL-1308 formulation, such as: 1) steady-state burning rates as a function of initial chamber pressure and propellant temperature; 2) temperature sensitivities; 3) temperature profiles in the condensed-phase; and 4) propellant activation energy. The experimental results were obtained by using a high-pressure optical strand burner. Steady-state burn rates were determined for pressure ranges of 20.7 to 62 MPa (3,000 to 6,000 psig) and initial propellant temperatures of 243 to 353 K. For the pressure and temperature ranges tested, the temperature sensitivity was on the order of 1 x 10(exp -3) K. The pressure dependency on the burning rate was correlated using the Saint Robert's power law. The pressure exponent for the room temperature case (T(i) = 25 C) was 0.75. Also, the pressure exponent, n, was found to be a function of initial propellant temperature. An Arrhenius form burning rate correlation was also obtained for this propellant. The activation energy and the pre-exponential factor of the Arrhenius equation are E(a) = 2.735 kcal/mot and A = 5.928 in/s, respectively. The pressure deflagration limit (PDL) for this propellant was found to be in the range from 1,200 to 1,250 psig. Below 2,500 psig, the propellant does not regress in the layer-by-layer form. However, for much higher pressures (above 3,000 psig), the layer-by-layer regression of the propellant strand was observed. During combustion, small spherical particles were ejected and recovered from the test run. The higher the pressure and initial propellant temperature; the smaller the spherical particles. For pressures below 6,000 psig, the size of the particles was on the order of 900 micro-m. For pressures around 12,500 psig, the bead size was much smaller, on the order of 300 micro-m. Chemical analysis on these particles using the ESEM method and the X-ray diffraction method was conducted. The X-ray diffraction results agreed well with the ESEM results and indicated that the material of the TAL beads was mostly sodium chloride, NaCl, with a small amount of silicon-containing compounds.

Author

Air Bag Restraint Devices; Burning Rate; Solid Propellants; Reaction Kinetics; Solid Propellant Combustion; Deflagration

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Combustion Instability Additive Investigation

Blomshield, Fred S., Naval Air Warfare Center, USA; Stalnaker, R. A., Naval Air Warfare Center, USA; Beckstead, Merrill W., Brigham Young Univ., USA; JANNAF 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 333-347; In English; See also 20000029419; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Combustion stability additives like zirconium carbide (ZrC), aluminum oxide (Al2O3) and zirconium orthosilicate (ZrSiO4) have long been known to suppress combustion instability in reduced smoke, composite propellant solid rocket systems. Often, as little as 0.5 percent additive can stabilize an otherwise unstable rocket motor. The additives appear to have effects on both linear and non-linear pulsed instabilities. Although several theories have been proposed, the actual mechanism on how stability additives work remains unknown. The common belief that additive particle damping alone stabilizes rocket motors is not true. Somehow,

the additives change the response behavior of the propellant. Past studies have shown that the additive effect is a combination of particle damping and a reduction in the combustion response of the propellant. In the past study, four propellants were studied containing 0, 1, 3, and 5 percent ZrC. In this study, the 3 percent propellant used before will be used again, except 3 percent HMX will be used in one formulation and 3 percent ultra fine aluminum or ALEX will be used in another. The emphasis here is to examine the combustion response changes. This paper will present the results of T-Burner response testing and compare the results to past propellants containing additives. The reason for the work is that recent evidence suggests that traditional additives may not work as well when solid motors are operating at higher pressures. In addition, additives like the ones proposed, add energy to the propellant which would be a performance advantage over classical additives like ZrC.
Author
Propellant Additives; Propellant Combustion; Composite Propellants; Combustion Stability; HMX; Rocket Propellants; Propellant Chemistry

20000029426 Pennsylvania State Univ., Dept. of Mechanical and Nuclear Engineering, University Park, PA USA
Development of a Thrust Response Measurement System for Pressure-Driven Combustion Studies
Kudva, G. N., Pennsylvania State Univ., USA; Lee, Y. J., Pennsylvania State Univ., USA; Litzinger, Tom A., Pennsylvania State Univ., USA; JANNAF 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 349-361; In English; See also 20000029419
Contract(s)/Grant(s): N00014-95-1-1338; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

A thrust response measurement system has been successfully developed for use during pressure-driven combustion studies. A pressure insensitive, sub-miniature load cell is used to measure thrust via a strain gage/cantilever beam setup. The load cell was placed in a ceramic holder to protect it from high combustion temperatures. The bottom of the holder was coated with dampers to reduce the effects of vibration from the pressure-driven combustion system. A CO, laser was used to ignite and sustain combustion. A digital oscilloscope and differential amplifier were used to record the signal. Load cell signals were also recorded with the pressure oscillation drivers running before and after combustion to ensure insensitivity to changes in the pressure conditions within the chamber. Measurements of thrust response to sinusoidal pressure-variations were made at frequencies ranging from 4 to 100 Hz. The pressure oscillation drivers were used to create a peak-to-peak pressure variation of approx. 10% of the mean. These tests were performed in atmospheric air. A minimum signal to noise ratio was 3:1.
Author
Pressure Oscillations; Solid Propellant Combustion; Burning Rate; Thrust; Solid Propellant Ignition; Combustion Chemistry

20000029434 Alabama Univ., Huntsville, AL USA
Issues in Nonlinear, Nonsteady Solid Combustion Modeling
Rasmussen, Bryan M., Alabama Univ., USA; Frederick, Robert A., Jr., Alabama Univ., USA; JANNAF 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 445-458; In English; See also 20000029419
Contract(s)/Grant(s): N00014-95-1-1338; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

The focus of the study is a heterogeneous solid combustion model that closely resembles the Beckstead-Derr-Price proposal. Most nonlinear, multiple-flame, separate surface temperature models are valid in the steady-state only, but the current model accounts for nonsteady effects through calculation of two temperature profiles in the solid phase (one for the binder, one for the AP). Some important questions have arisen in the course of model development. The most troubling issue is the over influence of burning rate on gas-phase heat flux. The problem is reparable by defining the flame heights and temperatures as functions of pressure only, but the authors believe there should be a more phenomenological method for obtaining reasonable results. Another issue is ambiguity in the definition of a 'response function' (Rp) for a nonlinear solution. Harmonic inputs do not induce harmonic outputs in nonlinear systems, so the 'mean' burning rate term in the standard pressure-coupled frequency response function is not well-defined. The authors explore several ways of calculating frequency response in nonlinear systems, and compare and contrast the answers. Finally, the paper contains some simulations of the response of the propellant to various pressure inputs. Some of the noticed trends are a decreasing Rp amplitude with increasing AP particle diameter, a very slightly increasing Rp amplitude with increasing pressure oscillation magnitude at low frequency, and a decreasing Rp with increasing mean pressure.
Author
Solid Propellant Combustion; Mathematical Models; Nonlinearity; Burning Rate; Combustion Chemistry

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Comparison of Different Approaches for the Approximate Analysis of Combustion Instabilities

Seywert, C., California Inst. of Tech., USA; Culick, F. E. C., California Inst. of Tech., USA; JANNAF 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 463-469; In English; See also 20000029419

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Understanding combustion instabilities requires a theoretical framework within which one may interpret results, design tests, and predict the behavior to be expected. This report is concerned with some aspects and applications of spatial averaging as a basis for an approximate analysis. In addition to the choice of the partial differential equations used in that analysis (a matter of expansion and ordering in small parameters) there are three essential defining features of the kind of analysis used here: choice of the independent vaiiable(s) to be expanded; choice of the spatial functions used in the series expansion; choice of the weighting functions with respect to which the spatial averaging is done, usually chosen to be the same as the expansion functions. The first section briefly introduces the Galerkin method and an extension of it introduced by Zinn which allows the expansion functions to be independent of the boundary conditions for the system. Section 2 reiterates the main steps of a modal expansion as applied by the authors and shows that this method is identical to the modified Galerkin method if the same equations, variables and expansion functions are used. The last section covers different applications of the modified Galerkin method and highlights some of the features that arise when different equations or variables are used.

Author

Combustion Stability; Solid Propellant Combustion; Series Expansion; Galerkin Method; Approximation

20000029437 Pennsylvania State Univ., Propulsion Engineering Research Center, University Park, PA USA

Combustion of AP/HTPB Composite Propellant in a Turbulent Flow with Acoustic Oscillations

Cai, Weidong, Pennsylvania State Univ., USA; Yang, Vigor, Pennsylvania State Univ., USA; JANNAF 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 471-483; In English; See also 20000029419

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Combustion of AP/HTPB composite propellant in a turbulent flow with acoustic oscillations has been studied numerically. The formulation treats the complete conservation equations of mass, momentum, energy, and species concentration, and accounts for finite-rate chemical kinetics. The combustion wave of AP/HTPB composite propellants involves three parts, namely, primary diffusion, primary premixed and final diffusion flame. The final diffusion is anchored at the edge of the AP primary premixed flame and contributes a major part of heat release in the combustion process. The effect of turbulence on flame structure is carefully examined. Turbulence does not penetrate all way to the near-surface combustion region, rendering minimal influence on heat release mechanism. A study on the interactions between flame dynamics and acoustic oscillations was conducted. The oscillatory heat release arising from acoustic oscillations represents a combination of driving and damping forces causing unsteady flow motions.

Author

Combustion Stability; Aluminum Perchlorates; HTPB Propellants; Solid Propellant Combustion; Composite Propellants; Turbulent Flow; Unsteady Flow

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Numerical Simulation of Combustion Instabilities in Solid Rocket Motors

Roh, Tae-Seong, California Inst. of Tech., USA; Culick, Fred E. C., California Inst. of Tech., USA; JANNAF 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 519-526; In English; See also 20000029419

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A model which can specify the variables of the interfacial boundary conditions between condensed and gas phases has been established. An extensive numerical analysis of unsteady motions in the rocket motor has been conducted. The formulation considers a 2-D axisymmetric rocket motor and treats the complete conservation equations of mass, momentum, and energy, accounting for turbulence closure in the gas phase. A fully-coupled implicit scheme based on a dual time-stepping integration algorithm has been adopted to solve the governing equations and associated boundary conditions including the new model. The boundary variables has been satisfactorily specified by the model as the substituted interfacial boundary conditions.

Author

Solid Propellant Rocket Engines; Combustion Stability; Computerized Simulation; Conservation Equations; Boundary Conditions; Vapor Phases; Solid Propellant Combustion; Turbulent Flow; Liquid Phases

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Modeling the Combustion Response Function with Surface and Gas Phase Dynamics

Culick, F. E. C., California Inst. of Tech., USA; Isella, G., California Inst. of Tech., USA; JANNAF 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 527-530; In English; See also 20000029419

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Considerable data exists suggesting that the response functions for many solid propellants tend to have higher values, in some ranges of frequencies, than predicted by the conventional QSHOD theory. It is a familiar idea that such behavior is associated with dynamical processes possessing characteristic times shorter than that of the thermal wave in the condensed phase. The QSHOD theory, and most of its variants, contain only the dynamics of that process, which normally has a characteristic frequency in the range of a few hundred hertz. To correct this deficiency, the dynamics of the thermal wave in the gas phase can be introduced in the analysis. The present paper presents a general framework for the analysis of the cas phase dynamics without use of the QSHOD theory. The analysis can also be extended by consideration of the thin layer adjacent to the interface of the condensed phase: the primary purpose of this work is to construct a simple model of the problem so that the possible dynamics of the that region may be incorporated.

Author

Solid Rocket Propellants; Mathematical Models; Solid Propellant Combustion; Vapor Phases; Gas Dynamics; Chemical Reactions

20000029442 Software and Engineering Associates, Inc., Carson City, NV USA

Analytic Combustion Stability Analysis of a Non-Axi-Symmetric Motor Cavity, Including Non-Axial Acoustic Modes: A Status Report

French, J. C., Software and Engineering Associates, Inc., USA; Dang, A. L., Software and Engineering Associates, Inc., USA; JANNAF 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 531-539; In English; See also 20000029419; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Analytic stability analyses of solid rocket motors examine the interaction between a motor cavity's acoustic resonant modes and the combustion processes which drive those resonances. Historically, such analysis has been limited to axial resonant modes, due to computational difficulties associated with computing non-axial modes. The current Standard Stability Program (SSP) has this limitation. Herein we present our current approach to enable analysis of non-axial modes within non-axi-symmetric motor cavities in the SSP. Our goal is to fully automate the system as a module of the Standard Performance Program (SPP), using the SPP's geometry specification (ver. 7) to define the cavity.

Author

Solid Propellant Rocket Engines; Solid Propellant Combustion; Combustion Stability; Combustion Physics; Acoustic Properties; Cavities; Frequency Domain Analysis

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Ignition and Combustion of Single Boron Particle in Fluorine/Oxygen Containing Environments

Ulas, Abdullah, Pennsylvania State Univ., USA; Kuo, Kenneth K., Pennsylvania State Univ., USA; Yeh, Chun-Liang, Pennsylvania State Univ., USA; JANNAF 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 549-563; In English; See also 20000029419

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An experimental setup was designed and utilized for the ignition and combustion of 1-gm amorphous and 3-gm crystalline boron particles in fluorine-containing environments. The boron particles ignited and burned completely in the post-flame region of a multi-diffusion flat-flame burner. The high-temperature gas environment was generated by the combustion of CH4/NF3/O2/N2 gases at atmospheric pressure. From recorded images of burning boron particles in fluorine-containing environments, no clear distinction was observed to define the two-stage combustion process which is characteristic of boron oxidation without fluorine. This lack of demarcation is believed to be due to the rapid removal of the boron oxide layer by fluorine-containing species. The burning trajectories of boron particles in fluorine-containing environments showed pronounced jetting and spinning phenomena which are attributed to an accumulation of a condensed or solid phase species on the particle surface, most probably boron nitride. Fragmentation of particles was also observed at some instances during test runs. From the deduced total burning times (t(b)) at a hot gas environment of 2,020 K, it was found that, at low total atomic fluorine-to-total atomic oxygen ratios (F/O), t(b) increases with F/O, which is mainly due to the replacement of H2O molecules (which are very reactive with boron) by less reactive HF molecules, the only fluorine-containing species in the low F/O region. When F/O increased beyond

a certain value, th started to decrease with the increase of F/0, since the concentration of very reactive atomic fluorine was also increased. For 3 mcro-m crystalline boron particles, th at F/O = 2.61 was 12% lower than the one at F/O = 0.0. At low flame temperatures around 1,780 K, the ignition of boron particles required higher total oxidizer concentration in oxygen-containing environments; however, in fluorine-containing environments, boron ignition was accomplished with a lower total oxidizer concentration. This study shows that fluorine-containing species can be used to increase the overall efficiency of boron combustion.
Author
Propellant Combustion; Boron; Chemical Reactions; Oxygen; Additives; Solid Propellant Ignition; Combustion Chemistry; Metal Combustion

20000029445 Princeton Univ., Dept. of Mechanical and Aerospace Engineering, NJ USA
Aluminum Particle Combustion in Fluorine-Containing Environments
Ernst, L. F., Princeton Univ., USA; Bucher, P., Princeton Univ., USA; Yetter, R. A., Princeton Univ., USA; Dryer, F. L., Princeton Univ., USA; JANNAF 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 565-575; In English; See also 20000029419
Contract(s)/Grant(s): N00014-95-1-1339; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Experimental results on the combustion of single, isolated aluminum particles, laser ignited in quiescent environments consisting of pure SF6 and in mixtures of SF6, O2 and Ar are reported. Combustion measurements consisted of photographic observations and electron probe microanalysis (EPMA) of the condensed-phase product composition and radial distribution. Aluminum particles in pure SF6 atmospheres were found to burn without condensed phase products in the surrounding envelope flames. Disruptive burning was not observed in any of the SF6/Ar mixtures. However, luminosity flashes from the combustion process were observed for the weakest burning SF6/Ar mixtures, in contrast to O2/Ar systems, where flashes are typically observed for the strongest mixtures. In SF6/Ar mixtures, the burning rates increase with increasing SF6 mole fraction up to about 50% SF6, above which the burning rate is nearly independent of the SF6 mole fraction. Burning rates for the SF6/Ar mixtures were approximately 15% below those of the O2/Ar mixtures for mixtures with less than 50% gaseous reactant. Condensed phase deposits on quenched particles indicate that the structure of the surrounding gaseous flame consists of two zones for aluminum reacting in SF6 and three zones for aluminum reacting in SF6/02 mixtures. For each system, near the surface, where the gas phase is aluminum rich, significant amounts of sulfur were found in the condensed phase products. At greater distances from the particle surface in the SF6 system, only Al and F were found in the condensed products, presumably as AlF3. In SF6/02 mixtures, Al2O3 was found in the condensed phase products outside of the aluminum-sulfur region, but inside the aluminum fluorine region. These results suggest for diffusion controlled combustion, SF6 as a source of fluorine to study the aluminum fluoride reaction likely introduces complexities through the diffusion barrier created by the presence of sulfur.
Author
Metal Combustion; Solid Propellant Combustion; Burning Rate; Microanalysis; Chemical Reactions; Aluminum; Combustion Chemistry

20000029446 Brigham Young Univ., Provo, UT USA
Aluminum Combustion Modeling in Solid Propellant Environments
Widener, J. F., Brigham Young Univ., USA; Liang, Y., Brigham Young Univ., USA; Beckstead, M. W., Brigham Young Univ., USA; JANNAF 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 577-592; In English; See also 20000029419
Contract(s)/Grant(s): N00014-95-1-1338; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

An improved numerical model of aluminum particle combustion has been developed based on previous modeling work done at Brigham Young University. Thermochemical calculations have been performed to determine the range of temperatures, pressures, and species distributions resulting from the combustion of various formulations of rocket propellants. The previously-developed model has been modified to take into account such species distributions at high temperatures and pressures. Kinetic rate equations are introduced for the homogeneous reaction of CO2 and H2O with aluminum. The model has produced results which are consistent with experimental data from many authors. In addition, the model has been used to predict aluminum combustion rates for the range of conditions predicted by thermochemical calculations to be present inside the rocket motor, for

which there are little or no experimental data. The effects of less reactive species such as HCl and H2 have been included for pressures up to 70 atm and temperatures up to 4000 K.
Author
Aluminum; Solid Propellant Combustion; Combustion Chemistry; Mathematical Models; Metal Combustion; Rocket Propellants

20000029447 Naval Air Warfare Center, China Lake, CA USA
Flame Structure Studies of Ultrafine-Aluminum Containing Propellants
Parr, T. P., Naval Air Warfare Center, USA; Hanson-Parr, D. M., Naval Air Warfare Center, USA; JANNAF 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 593-603; In English; See also 20000029419
Contract(s)/Grant(s): N00014-98-WX-20347; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

We have applied planar laser-induced fluorescence (PLIF), UV/visible absorption spectroscopy, and high-magnification video imaging to flames of a new class of nano-aluminum based propellant (ultra-fine aluminum, or UFAL) and ”standard” aluminized propellants, such as Shuttle booster propellant as well as a research aluminized nitramine propellant (ANP), and to dry mixed pressed pellets of AP/binder and HMX/binder with Alex and LANL UFAL, to study the AlO in these flames. Some of the UFAL propellants showed less agglomeration of the Al than either the SBP or ANP. The formulation still has a fraction of the Al as 5 micro-m so there were still some agglomerates. Some of the UFAL propellants showed a strong flame relatively close to the surface with relatively high AlO concentration showing that some of the aluminum is burning relatively close to the surface. The conventional aluminized propellants (and some of the UFAL samples) showed a large fraction of the Al burning as very big agglomerates away from the surface. The AlO concentration in the flame was quantified using visible absorption. The AlO concentration for the conventional propellants was too low to measure. For the ANP propellant, during the start of the burn before the 5 micron Al had time to agglomerate on the surface, a diffuse cloud of AlO was seen in PLIF and absorption spectroscopy. The average AlO concentration under these conditions was found to be 50 - 70 ppm. The AlO concentration from one of the nano-aluminum propellants was as high as 130 ppm showing faster combustion of the aluminum over the 5 micro-m Al based nitramine propellant.
Author
Absorption Spectroscopy; Flames; Propellant Additives; Laser Induced Fluorescence; Imaging Techniques; Solid Propellant Combustion; Metal Combustion; Aluminum

20000029448 Rohm and Haas Co., Huntsville, AL USA
Mechanisms and Methods of Suppression of Oscillatory Burning by Metallic Additives
Waesche, R. H. Woodward, Rohm and Haas Co., USA; JANNAF 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 605-615; In English; See also 20000029419; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Following the discovery of suppression of unstable burning in solid-propellant rocket motors by the inclusion of aluminum powder in the compositions, studies showed a variation of effects of different grades of aluminum. Later investigations with a variety of additives evaluated the relative importance of thermal conductivity, attenuation by solid particles, and heat addition as suppression mechanisms. Cinemicrographic studies of burning in window bombs led to predictions which were experimentally verified by results of vented-vessel firings.
Author
Solid Propellant Combustion; Combustion Stability; Burning Rate; Solid Propellant Rocket Engines; Powdered Aluminum; Additives

20000029449 Delaware Univ., Dept. of Chemistry, Newark, DE USA
Flash Pyrolysis of Mixtures of AP and HTPB and the Effect of TiO2 and Melamine Additives
Brill, T. B., Delaware Univ., USA; Budenz, B. T., Delaware Univ., USA; JANNAF 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 617-628; In English; See also 20000029419
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The focus of this paper is the flash-pyolysis chemistry of AP-HTPB mixtures with and without TiO2 and melamine additives. The AP-HTPB mixture is thermally less stable in terms of the time-to-exotherm than the pure ingredients, which indicates that interfacial radical chemistry occurs. The effects of different pyrolysis temperatures (400-440 C) and AP particle sizes (1.2, 8, 18, and 44 micro-m) on the mole fractions of the gaseous products are discussed. The implications of product ratios involving C2H2, C02, and NH4Cl give insight into the relative roles of interfacial AP-HTPB radical reactions that break up the components and

produce the subsequent radical reactions. The effect of pressure at 4-50 atm is discussed on these processes. Adding TiO2 does not affect the time-to-exotherm but accelerates the rate of gaseous product formation. Melamine lengthens the time-to-exotherm but does not change the AP-HTPB chemistry as reflected in the product distributions. The implications of these findings on burning rate modification are discussed.
Author
Pyrolysis; Aluminum Perchlorates; HTPB Propellants; Titanium Oxides; Additives; Propellant Combustion; Combustion Chemistry; Melamine

20000029450 Illinois Univ. at Urbana-Champaign, Urbana, IL USA
Flame Structure of Composite Solid Propellants from Emission Imaging
Chorpening, B. T., Illinois Univ. at Urbana-Champaign, USA; Brewster, M. Q., Illinois Univ. at Urbana-Champaign, USA; JANNAF 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 629-637; In English; See also 20000029419
Contract(s)/Grant(s): N00014-95-1-1339; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Initial emission imaging experiments have been performed to directly investigate the flame structure above sandwiches of ammonium perchlorate and hydroxyl-terminated polybutadiene binder. All samples were tested under nitrogen, pressurized from 50 to 380 psia (0.34 to 2.6 MPa). Binder laminae were approximately 100 micro-m thick. A narrowband (10 nm FWHM) dielectric filter centered at 310 nm has been used to attempt to limit the detected signal to chemiluminescent emission from electronically excited C, OH. Initial results show a strong diffusion flame and weak (partially premixed) side branches, i.e. tribrachial or triple flame structure.
Author
Ammonium Perchlorates; Diffusion Flames; Sandwich Structures; Composite Propellants; Propellant Binders; HTPB Propellants; Imaging Techniques

20000029451 Brigham Young Univ., Provo, UT USA
A Kinetic Model for the Premixed Combustion of a Fine AP/HTPB Composite Propellant
Jeppson, M. B., Brigham Young Univ., USA; Beckstead, M. W., Brigham Young Univ., USA; Jing, Q., Brigham Young Univ., USA; JANNAF 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 639-653; In English; See also 20000029419
Contract(s)/Grant(s): N00014-95-1-1338; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

A model for the premixed combustion of a fine, monomodal Ammonium Perchlorate (AP)/Hydroxyl-terminated Polybutadiene (HTPB) composite propellant is presented. The model accounts for the combustion of the composite propellant including: solid decomposition, condensed-/multi-phase region at the burning surface with a semi-global decomposition mechanism, and a premixed gas phase flame with detailed kinetics. Novel kinetic mechanisms for the condensed- and gas-phases are also presented. This model is a necessary precursor to a more detailed model that would account for multi-modal composite propellants with larger-sized AP particles and the corresponding diffusion flame. The model accurately describes burn rate versus pressure data for low to moderate pressure. Calculated results for temperature versus distance from the burning surface are also presented and discussed, as are calculations for temperature sensitivity. Sensitivity analysis is also presented, identifying the condensed-and gas-phase reaction steps that have the greatest influence on the heat flux.
Author
Ammonium Perchlorates; HTPB Propellants; Models; Solid Propellant Combustion; Composite Propellants; Reaction Kinetics; Premixed Flames

20000029452 Illinois Univ. at Urbana-Champaign, Dept. of Mechanical and Industrial Engineering, Urbana, IL USA
Simplified Modeling of Composite Propellant Combustion with Finite Peclet Number
Knott, G. M., Illinois Univ. at Urbana-Champaign, USA; Brewster, M. Q., Illinois Univ. at Urbana-Champaign, USA; Jackson, T. L., Illinois Univ. at Urbana-Champaign, USA; JANNAF 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 655-669; In English; See also 20000029419
Contract(s)/Grant(s): N00014-95-1-1339; B341494; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

A combustion model has been formulated to solve the burning rate eigenvalue problem for a model im composite solid propellant, similar to what has been done previously for homogeneous energetic solids. A two-step reaction sequence (high activation energy condensed phase decomposition followed by low activation energy gas phase heat release) has been extended

from one to two dimensions for non-premixed (heterogeneous fuel/oxidizer) composite solids. Gas phase streamwise diffusion, the primary driving force for solid pyrolysis, has been accounted for by including a finite value of the Peclet number. Two possible gas phase reaction schemes, one dependent only upon oxidizer mass fraction, and the other a function of both oxidizer and fuel concentration are considered. The results show that the value of the Peclet number, a non-dimensional burning rate, is constrained to a reasonably small interval by the eigenvalue expression obtained from activation energy asymptotic analysis of the condensed phase thermal decomposition zone. The present model is limited to propellants in which diffusion flame and particle size effects are minimal such as nitramine composites, but the approach is amenable to more complex chemical kinetics as they become known.
Author
Combustion Chemistry; Composite Propellants; Models; Solid Propellant Combustion; Burning Rate; Diffusion Flames

20000029453 Naval Air Warfare Center, Weapons Div., China Lake, CA USA
Spontaneous Raman Spectroscopy Applied to AP/Methane Counter-Flow Diffusion Flame
Parr, T. P., Naval Air Warfare Center, USA; Hanson-Parr, D. M., Naval Air Warfare Center, USA; Smooke, M., Yale Univ., USA; Yetter, R., Princeton Univ., USA; JANNAF 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 671-685; In English; See also 20000029419
Contract(s)/Grant(s): N00014-98-WX-20347; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Last year we had begun studies of the diffusion flame structure between solid AP and gaseous fuels such as methane and ethylene using the counter-flow configuration. Many species were measured experimentally: soot/PAH, NH, CN, and OH profiles and OH rotational temperature through Planar Laser-Induced Fluorescence, NO and OH concentrations through absorption spectroscopy, and profiles of excited species NH*, CN*, CH*, C2*, and OH*, through emission spectroscopy using a two-dimensional optical multichannel analyzer (OMA), and radiation-corrected thermocouple measurements were done to obtain temperature profiles throughout the entire flame. The results were compared to modeling efforts in a companion paper, showing excellent agreement. The modeling results included profiles of majority species such as HCl, CH4, H2O, O2, and NO. Since we were only able to measure absolute NO using PLIF/absorption, we decided to try to measure the other species with spontaneous Raman spectroscopy. Because the flame was relatively stable, many second averages were attainable, providing the necessary S/N to extract meaningful Raman results. Output from a Nd(3+)-YAG laser was doubled to 532 nm for the measurements and a 532 nm-holographic notch filter was used to block the intense Rayleigh/Mie scattering signal. The detector consisted of a 0.2m spectrograph with 300 gr/mm grating and a one-dimensional OMA. The wavelength range covered was large enough to capture as many species as possible for one setting, with a spectral resolution of about 30 cm(exp -1). The species quantified included HCl, CH4, H2O, O2, NO, and N2. We report on the Raman measurements here.
Author
Raman Spectroscopy; Diffusion Flames; Aluminum Perchlorates; Methane; Propellant Combustion; Laser Induced Fluorescence

20000029454 Yale Univ., Dept. of Mechanical Engineering, New Haven, CT USA
Modeling Counterflow Ammonium Perchlorate Diffusion Flames
Smooke, M. D., Yale Univ., USA; Yetter, R. A., Princeton Univ., USA; Parr, T. P., Naval Air Warfare Center, USA; Hanson-Parr, D. M., Naval Air Warfare Center, USA; Tanoff, M. A., W. K. Kellogg Inst., USA; JANNAF 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 687-698; In English; See also 20000029419
Contract(s)/Grant(s): N00014-95-1-0412; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

We investigate the modeling of counterflow diffusion flames in which the products of AP combustion are counterflowed against an ethylene fuel stream. The two-dimensional problem can be reduced to a one-dimensional boundary value problem along the stagnation point streamline through the introduction of a similarity transformation. by utilizing recent developments in hydrocarbon, chlorine, NOx and AP kinetics, we can formulate a detailed transport, finite rate chemistry system for the temperature, velocity and species mass fractions of the combined flame system. A detailed soot model is included which can predict soot volume fractions as a function of the strain rate and the fuel mole fraction. We compare the results of this model with a series of experimental measurements in which the temperature is measured with radiation- corrected thermocouples and OH rotational population distribution, several important species are measured with planar laser induced fluorescence and emission spectroscopy and the soot volume fraction is measured with laser-induced incandescence.
Author
Ammonium Perchlorates; Counterflow; Diffusion Flames; Models; Propellant Combustion

20000029455 Pennsylvania State Univ., Dept. of Mechanical and Nuclear Engineering, University Park, PA USA
Flame Structure and Combustion Behavior of Nitromethane
Boyer, E., Pennsylvania State Univ., USA; Kuo, K. K., Pennsylvania State Univ., USA; JANNAF 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 699-706; In English; See also 20000029419
Contract(s)/Grant(s): DAAH04-93-D-0364; DAAH04-96-1-0054; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

An ultra-high pressure strand burner has been established and tested to work at pressures up to 30,000 psi. This facility was used to obtain burning rates for nitromethane liquid monopropellant over wide range of pressures. Two distinct regimes were observed: below about 15 MPa, the power law exponent was 1.03. Above this pressure, the exponent suddenly changed to 2.02. A one-dimensional gas-phase code based on the Chemkin-II libraries was used to obtain species and temperature profiles for nitromethane combustion. The main product species at 100 atm were H2O, CO, H2, N2, and CO2 with significant levels of HCN and NO as intermediate reactants. The 200 micron reaction zone compared favorably to flame observations.
Author
Flames; Nitromethane; Burning Rate; Burners; Monopropellants; Propellant Combustion

20000029594 Pennsylvania Dept. of Transportation, Engineering and Information Technology Div., Harrisburg, PA USA
Evaluation of Corrosion-Inhibiting Concrete Admixtures ***Final Report, Jul. 1995 - Jun. 1997***
Sukley, R.; Bartoski, T. A.; Nov. 1998; 82p; In English
Report No.(s): PB2000-103120; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy

This report evaluates the use of corrosion-inhibiting admixtures for constructability, and workability when used along with epoxy coated rebar. Deicing agents contain chloride ions that corrode the steel reinforcement. An epoxy-coated rebar has been used since the 1970's however the epoxy coating controls the problem only to an extent. Corrosion of the steel reinforcements still occurs. As a result, the Department is interested in the performance of corrosion-inhibiting concrete admixtures. Two manufacturers, Sika Corporation and W.R. Grace Concrete Products, supplied corrosion-inhibiting concrete admixtures to be tested for their workability, constructability, placement, and performance. According to the contractor's personnel, and the Departments inspectors, there were no workability, constructability, or placement problems with the corrosion-inhibiting admixtures. Periodic checks have been made since construction, and the two test bridges appear to be performing well.
NTIS
Admixtures; Concretes; Corrosion Prevention; Inhibitors

20000030656 NASA Kennedy Space Center, Cocoa Beach, FL USA
Conducting Compositions of Matter
Viswanathan, Tito, Inventor, NASA Kennedy Space Center, USA; Oct. 19, 1999; 10p; In English; Provisional application US-Patent-Appl-SN-040786, filed 3 Mar. 1997
Patent Info.: Filed 3 Mar. 1998; NASA-Case-KSC-11940; US-Patent-5,968,417; US-Patent-Appl-SN-034063; US-Patent-Appl-SN-040786; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The invention provides conductive compositions of matter, as well as methods for the preparation of the conductive compositions of matter, solutions comprising the conductive compositions of matter, and methods of preparing fibers or fabrics having improved anti-static properties employing the conductive compositions of matter.
Official Gazette of the U.S. Patent and Trademark Office
Procedures; Technology Assessment; Conductivity Meters

20000030670 California Univ., Mechanical and Aerospace Engineering Dept., Irvine, CA USA
On the Alignment of Strain, Vorticity and Scalar Gradient in Turbulent, Buoyant, Nonpremixed Flames
Boratav, O. N., California Univ., USA; Elghobashi, S. E., California Univ., USA; Zhong, R., California Univ., USA; Physics of Fluids; September 1999; ISSN 1070-6631; Volume 10, No. 9, pp. 2260-2267; In English
Contract(s)/Grant(s): NGT3-52300; RTOP 101-53; Copyright Waived; Avail: Issuing Activity, Hardcopy

The alignment of vorticity and scalar gradient with the eigendirections of the rate of strain tensor is investigated in turbulent buoyant nonpremixed horizontal and vertical flames. The uniqueness of a buoyant nonpremixed flame is that it contains regions with distinct alignment characteristics. The strain-enstrophy angle Psi is used to identify these regions. Examination of the vorticity field and the vorticity production in these different regions indicates that Psi and consequently the alignment properties near the flame surface identified by the mixture fraction band F approximately equals F(sub st) differ from those in the fuel region, F is greater than F(sub st) and the oxidizer region, F is less than F(sub st). The F approximately equals F(sub st) band shows strain-dominance resulting in vorticity/alpha alignment while F is greater than F(sub st) (and F is less than F(sub st) for the vertical

flame) band(s) show(s) vorticity/beta alignment. The implication of this result is that the scalar dissipation, epsilon(sub F), attains its maximum value always near F approximately equals F(sub st). These results are also discussed within the framework of recent dynamical results [Galanti et al., Nonlinearity 10, 1675 (1997)] suggesting that the Navier-Stokes equations evolved towards an attracting solution. It is shown that the properties of such an attracting solution are also consistent with our results of buoyant turbulent nonpremixed flames.
Author
Alignment; Tensors; Tensor Analysis; Scalars; Gradients; Turbulent Flames; Flame Propagation

20000030671 University of Southern California, Dept. of Aerospace and Mechanical Engineering, Los Angeles, CA USA
Dynamics and Structure of Dusty Reacting Flows: Inert Particles in Strained, Laminar, Premixed Flames
Egolfopoulos, Fokion N., University of Southern California, USA; Campbell, Charles S., University of Southern California, USA; Combustion and Flame; 1999; ISSN 0010-2180; Volume 117, pp. 206-226; In English
Contract(s)/Grant(s): NAG3-1877; RTOP 101-52; Copyright Waived; Avail: Issuing Activity, Hardcopy

A detailed numerical study was conducted on the dynamics and thermal response of inert, spherical particles in strained, laminar, premixed hydrogen/air flames. The modeling included the solution of the steady conservation equations for both the gas and particle phases along and around the stagnation streamline of an opposed-jet configuration, and the use of detailed descriptions of chemical kinetics and molecular transport, For the gas phase, the equations of mass, momentum, energy, and species are considered, while for the particle phase, the model is based on conservation equations of the particle momentum balance in the axial and radial direction, the particle number density, and the particle thermal energy equation. The particle momentum equation includes the forces as induced by drag, thermophoresis, and gravity. The particle thermal energy equation includes the convective/conductive heat exchange between the two phases, as well as radiation emission and absorption by the particle. A one-point continuation method is also included in the code that allows for the description of turning points, typical of ignition and extinction behavior. As expected, results showed that the particle velocity can be substantially different than the gas phase velocity, especially in the presence of large temperature gradients and large strain rates. Large particles were also found to cross the gas stagnation plane, stagnate, and eventually reverse as a result of the opposing gas phase velocity. It was also shown that the particle number density varies substantially throughout the flowfield, as a result of the straining of the flow and the thermal expansion. Finally, for increased values of the particle number density, substantial flame cooling to extinction states and modification of the gas phase fluid mechanics were observed. As also expected, the effect of gravity was shown to be important for low convective velocities and heavy particles. Under such conditions, simulations indicate that the magnitude and direction of the gravitational force can substantially affect the profiles of the particle velocity, number density, mass flux, and temperature.
Author
Dust; Reacting Flow; Flame Propagation; Premixed Flames; Turbulent Flames; Laminar Flow; Turbulent Flow; Turbulent Combustion

20000030672 NASA Lewis Research Center, Cleveland, OH USA
Fuel Preheat Effects on Soot-Field Structure in Laminar Gas Jet Diffusion Flames Burning in 0-g and 1-g
Konsur, Bogdan, Illinois Univ., USA; Megaridis, Constantine M., Illinois Univ., USA; Griffin, Devon W., NASA Lewis Research Center, USA; Combustion and Flame; 1999; ISSN 0010-2180; Volume 116, pp. 334-347; In English
Contract(s)/Grant(s): NGT3-52300; RTOP 101-53; Copyright Waived; Avail: Issuing Activity, Hardcopy

An experimental investigation conducted at the 2.2-s drop tower of the NASA Lewis Research Center is presented to quantify the influence of moderate fuel preheat on soot-field structure within 0-g laminar gas jet diffusion flames. Parallel work in 1-g is also presented to delineate the effect of elevated fuel temperatures on soot-field structure in buoyant flames. The experimental methodology implements jet diffusion flames of nitrogen-diluted acetylene fuel burning in quiescent air at atmospheric pressure. Fuel preheat of approximately 100 K in the 0-g laminar jet diffusion flames is found to reduce soot loadings in the annular region, but causes an increase in soot volume fractions at the centerline. In addition, fuel preheat reduces the radial extent of the soot field in 0-g. In 1-g, the same fuel preheat levels have a more moderated influence on soot loadings in the annular region, but are also seen to enhance soot concentrations near the axis low in the flame. The increased soot loadings near the flame centerline, as caused by fuel preheat, are consistent with the hypothesis that preheat levels of approximately 100 K enhance fuel pyrolysis rates. The results show that the growth stage of particles transported along the soot annulus is shortened both in 1-g and 0-g when elevated fuel temperatures are used.
Author
Heating; Fuels; Soot; Laminar Flow; Gas Flow; Jet Flow; Diffusion Flames; Combustion

20000030673 Case Western Reserve Univ., Dept. of Mechanical and Aerospace Engineering, Cleveland, OH USA

Numerical Simulation of Combustion and Extinction of a Solid Cylinder in Low-Speed Cross Flow

Tien, J. S., Case Western Reserve Univ., USA; Yang, Chin Tien, Case Western Reserve Univ., USA; Journal of Heat Transfer; November 1998; Volume 120, pp. 1055-1063; In English

Contract(s)/Grant(s): NAG3-1046; Copyright Waived; Avail: Issuing Activity, Hardcopy

The combustion and extinction behavior of a diffusion flame around a solid fuel cylinder (PMMA) in low-speed forced flow in zero gravity was studied numerically using a quasi-steady gas phase model. This model includes two-dimensional continuity, full Navier Stokes' momentum, energy, and species equations with a one-step overall chemical reaction and second-order finite-rate Arrhenius kinetics. Surface radiation and Arrhenius pyrolysis kinetics are included on the solid fuel surface description and a parameter Phi, representing the percentage of gas-phase conductive heat flux going into the solid, is introduced into the interfacial energy balance boundary condition to complete the description for the quasi-steady gas-phase system. The model was solved numerically using a body-fitted coordinate transformation and the SIMPLE algorithm. The effects of varying freestream velocity and Phi were studied. These parameters have a significant effect on the flame structure and extinction limits. Two flame modes were identified: envelope flame and wake flame. Two kinds of flammability limits were found: quenching at low-flow speeds due to radiative loss and blow-off at high flow speeds due to insufficient gas residence time. A flammability map was constructed showing the existence of maximum Phi above which the solid is not flammable at any freestream velocity.

Author

Simulation; Combustion; Extinction; Low Speed; Cross Flow; Diffusion Flames; Flammability

20000030674 NASA Lewis Research Center, Cleveland, OH USA

Shapes of Nonbuoyant Round Luminous Hydrocarbon/Air Laminar Jet Diffusion Flames

Lin, K.-C., Michigan Univ., USA; Faeth, G. M., Michigan Univ., USA; Sunderland, P. B., NASA Lewis Research Center, USA; Urban, D. L., NASA Lewis Research Center, USA; Yuan, Z.-G., NASA Lewis Research Center, USA; Combustion and Flame; 1999; ISSN 0010-2180; Volume 116, pp. 415-431; In English

Contract(s)/Grant(s): NAG3-2048; NAG3-1245; RTOP 101-12-OA; Copyright Waived; Avail: Issuing Activity, Hardcopy

The shapes (luminous flame boundaries) of round luminous nonbuoyant soot-containing hydrocarbon/air laminar jet diffusion flames at microgravity were found from color video images obtained on orbit in the Space Shuttle Columbia. Test conditions included ethylene- and propane-fueled flames burning in still air at an ambient temperature of 300 K, ambient pressures of 35-130 kPa, initial jet diameters of 1.6 and 2.7 mm, and jet exit Reynolds numbers of 45-170. Present test times were 100-200 s and yielded steady axisymmetric flames that were close to the laminar smoke point (including flames both emitting and not emitting soot) with luminous flame lengths of 15-63 mm. The present soot-containing flames had larger luminous flame lengths than earlier ground-based observations having similar burner configurations: 40% larger than the luminous flame lengths of soot-containing low gravity flames observed using an aircraft (KC-135) facility due to reduced effects of accelerative disturbances and unsteadiness; roughly twice as large as the luminous flame lengths of soot-containing normal gravity flames due to the absence of effects of buoyant mixing and roughly twice as large as the luminous flame lengths of soot-free low gravity flames observed using drop tower facilities due to the presence of soot luminosity and possible reduced effects of unsteadiness. Simplified expressions to estimate the luminous flame boundaries of round nonbuoyant laminar jet diffusion flames were obtained from the classical analysis of Spalding (1979); this approach provided Successful Correlations of flame shapes for both soot-free and soot-containing flames, except when the soot-containing flames were in the opened-tip configuration that is reached at fuel flow rates near and greater than the laminar smoke point fuel flow rate.

Author

Shapes; Buoyancy; Hydrocarbons; Air Jets; Laminar Flow; Jet Flow; Diffusion Flames; Combustion

20000030703 Rutherford Appleton Lab., ISIS Facility, Chilton, UK

GUIDE-IRIS Data Analysis

Telling, M. T. F.; Howells, W. S.; Jan. 2000; ISSN 1358-6254; 88p; In English

Report No.(s): PB2000-103164; RAL-TR-2000-004; Copyright; Avail: National Technical Information Service (NTIS)

The report provides a single, comprehensive point of reference to the suite of software available for the analysis of neutron scattering data collected on the IRIS spectrometer at the ISIS facility, UK. It supersedes 'IDA - Iris Data Analysis, W.S. Howells, 1996, RAL-TR-96-006' and incorporates 'IGIS - A Graphical User Interface, W.S. Howells et al, 1997, RAL-TR-97-074'. Historically, many of the programs used for Iris Data Analysis (IDA) have existed for decades. In fact, many evolved from packages originally used at the Institut Laue Langevin (ILL), Grenoble, France, having been adapted, and improved, for use at

ISIS. However, as new routines and ideas are developed, such as the technique of Bayesian analysis, so the IDA package, and therefore this manual, will be updated and modified.
NTIS
Neutron Scattering; Data Processing

20000030719 Department of the Navy, Washington, DC USA
Compounds Labeled With Cyanate or Thiocyanate Metal Complexes for Detecting by Infrared Spectroscopy
Conrad, David W., Inventor; Patterson, Charles H., Jr., Inventor; Jul. 13, 1999; 6p; In English; Supersedes , AD-D019329.
Patent Info.: Filed 9 Jun. 98,; US-Patent-Appl-SN-09-095-025; US-Patent-5,922,552
Report No.(s): AD-D019603; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A labeled compound detectable by IR spectroscopy contains at least one histidine residue bound to a cyanate or thiocyarate metal complex that has an IR absorption band within the spectral region of 2399-1900/cm. An assay reagent for simultaneously detecting or determining a plurality of different analytes in a sample is made up of a plurality of different labeled compounds, each being independently distinguishable from the ethers by absorbing energy in a different and distinguishable region in the range of 2300 to 1900/cm.
DTIC
Infrared Spectroscopy; Cyanates; Complex Compounds

20000030722 NASA Lewis Research Center, Cleveland, OH USA
Soot Aerosol Properties in Laminar Soot-Emitting Microgravity Nonpremixed Flames
Konsur, Bogdan, Illinois Univ., USA; Megaridis, Constantine M., Illinois Univ., USA; Griffin, Devon W., NASA Lewis Research Center, USA; Combustion and Flame; 1999; ISSN 0010-2180; Volume 118, pp. 509-520; In English
Contract(s)/Grant(s): NGT3-52300; RTOP 101-53; Copyright Waived; Avail: Issuing Activity, Hardcopy

The spatial distributions and morphological properties of the soot aerosol are examined experimentally in a series of 0-g laminar gas-jet nonpremixed flames. The methodology deploys round jet diffusion flames of nitrogen-diluted acetylene fuel burning in quiescent air at atmospheric pressure. Full-field laser-light extinction is utilized to determine transient soot spatial distributions within the flames. Thermophoretic sampling is employed in conjunction with transmission electron microscopy to define soot microstructure within the soot-emitting 0-g flames. The microgravity tests indicate that the 0-g flames attain a quasi-steady state roughly 0.7 s after ignition, and sustain their annular structure even beyond their luminous flame tip. The measured peak soot volume fractions show a complex dependence on burner exit conditions, and decrease in a nonlinear fashion with decreasing characteristic flow residence times. Fuel preheat by approximately 140 K appears to accelerate the formation of soot near the flame axis via enhanced fuel pyrolysis rates. The increased soot presence caused by the elevated fuel injection temperatures triggers higher flame radiative losses, which may account for the premature suppression of soot growth observed along the annular region of preheated-fuel flames. Electron micrographs of soot aggregates collected in 0-g reveal the presence of soot precursor particles near the symmetry axis at midflame height, The observations also verify that soot primary particle sizes are nearly uniform among aggregates present at the same flame location, but vary considerably with radius at a fixed distance from the burner. The maximum primary size in 0-g is found to be by 40% larger than in 1-g, under the same burner exit conditions. Estimates of the number concentration of primary particles and surface area of soot particulate phase per unit volume of the combustion gases are also made for selected in-flame locations.
Author
Soot; Aerosols; Flames; Laminar Flow

20000030729 Purdue Univ., School of Mechanical Engineering, West Lafayette, IN USA
Response Enhancement for PITLIF Instrument ***Final Report, 15 Jun. 1996 - 31 Dec. 1999***
King, Galen B., Purdue Univ., USA; Laurendeau, Normand M., Purdue Univ., USA; Jan. 21, 2000; 34p; In English
Contract(s)/Grant(s): F49620-96-1-0272; AF Proj. 3484
Report No.(s): AD-A373455; AFRL-SR-BL-TR-00-0024; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Previous work for AFOSR has demonstrated the feasibility of picosecond time-resolved laser-induced fluorescence (PITLIF) for real-time, quenching-corrected measurements of minor species concentrations in laminar and turbulent flames. Specifically, time-series measurements of CH and OH fluorescence have been demonstrated for the first time via PITLIF. These measurements can provide power spectral densities (PDFs) as well as the more traditional probability density functions (PDFs). However, the quenching rate coefficient must simultaneously be measured to quantify the fluorescence time series, and this was not previously accomplished. In this report, a new photon-counting procedure is presented that possesses the data processing rate required for quantitative concentration measurements on a time scale shorter than that characteristic of turbulence. This technique was first

applied to laminar flames, and a correction procedure which accounts for the nonlinear response of the photon-counting system was derived for extension of the technique to turbulent flames. The fully developed PITLIF instrument was then applied to the first known measurements of quantitative OH time series in turbulent reacting jets.
DTIC
Laser Induced Fluorescence; Laminar Flow; Flames; Turbulent Flames; Real Time Operation

20000031389 Department of the Navy, Washington, DC USA
Oily Waste Water Treatment System
Thompkins, Kevin T., Inventor; Stefanko, Jerome S., Inventor; Owsenek, Brain L., Inventor; Tomlinson, Lawrence W., Inventor; Gavin, Joseph A., Inventor; Aug. 03, 1999; 8p; In English; Supersedes , AD-D019338.
Patent Info.: Filed 22 Jan. 98,; US-Patent-Appl-SN-09-012-016; US-Patent-5-932-091
Report No.(s): AD-D019594; No Copyright; Avail: US Patent and Trademark Office, Microfiche

The effluent outflow from a shipboard oil/water separator is further reduced in oil content by passage through ultrafiltration membranes arranged in series as an added down stream treatment prior to overboard discharge. Effluent from the oil/water separator is buffered by delivery through a feed pump and use of a recirculation pump through which such downstream ultrafiltration treatment is subject to conditional flow control as well as periodic backflush cleansing of the filter membranes.
DTIC
Oils; Waste Water; Flushing; Cleaning; Water Treatment; Patent Applications

20000031747 Department of the Navy, Washington, DC USA
Concentration of Isotopic Hydrogen by Temperature Gradient Effect in Soluble Metal
Uhm, Han S., Inventor; Lee, Woodrow W., Inventor; Aug. 24, 1999; 12p; In English; Supersedes US-Patent-Appl-SN-07749357, AD-D015062.
Patent Info.: Filed 23 Aug. 91,; US-Patent-Appl-SN-07,749,357; US-Patent-5,942,206
Report No.(s): AD-D019535; No Copyright; Avail: US Patent and Trademark Office, Microfiche

Isotopic hydrogen enrichment in a soluble metal is achieved through temperature gradient effects by applying a heat source and a heat sink to two spaced regions of the metal within which isotopic hydrogen atoms are absorbed and enclosed by a diffusion-barrier material. The temperature gradient so created forces the atoms of hydrogen in the hot region to migrate into the cold region, resulting in higher isotopic hydrogen density in the cold region. Discharge of the absorbed isotopic hydrogen is prevented effectively by the diffusion-barrier material.
DTIC
Deuterium; Palladium; Patents; Metal-Gas Systems; Isotopes

20000031770 NASA Glenn Research Center, Cleveland, OH USA
LSENS, The NASA Lewis Kinetics and Sensitivity Analysis Code
Radhakrishnan, K., NASA Glenn Research Center, USA; February 2000; 18p; In English; 35th; 35th Joint Propulsion Conference and Exhibit, 20-24 Jun. 1999, Los Angeles, CA, USA
Contract(s)/Grant(s): NCC3-622; RTOP 523-26-33
Report No.(s): NASA/CR-2000-209814; NAS 1.26:209814; ICOMP-2000-02; E-12123; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A general chemical kinetics and sensitivity analysis code for complex, homogeneous, gas-phase reactions is described. The main features of the code, LSENS (the NASA Lewis kinetics and sensitivity analysis code), are its flexibility, efficiency and convenience in treating many different chemical reaction models. The models include: static system; steady, one-dimensional, inviscid flow; incident-shock initiated reaction in a shock tube; and a perfectly stirred reactor. In addition, equilibrium computations can be performed for several assigned states. An implicit numerical integration method (LSODE, the Livermore Solver for Ordinary Differential Equations), which works efficiently for the extremes of very fast and very slow reactions, is used to solve the ”stiff” ordinary differential equation systems that arise in chemical kinetics. For static reactions, the code uses the decoupled direct method to calculate sensitivity coefficients of the dependent variables and their temporal derivatives with respect to the initial values of dependent variables and/or the rate coefficient parameters. Solution methods for the equilibrium and post-shock conditions and for perfectly stirred reactor problems are either adapted from or based on the procedures built into the NASA code CEA (Chemical Equilibrium and Applications).
Author
Applications Programs (Computers); Sensitivity; FORTRAN; Reaction Kinetics; Mathematical Models; NASA Programs

20000031948 Aerospace Corp., El Segundo, CA USA

Electrochemical Voltage Spectroscopy for Analysis of Nickel Electrodes

Thaller, L. H.; Zimmerman, A. H.; To, G. A.; Jan. 10, 2000; 21p; In English

Contract(s)/Grant(s): F04701-93-C-0094

Report No.(s): AD-A373638; TR-2000(8555)-3; SMC-TR-00-02; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Electrochemical Voltage Spectroscopy (EVS) is a technique that directly measures the density of electrochemically active states in an electrode as a function of the applied voltage. In EVS measurements, the voltage of an electrode is scanned at a rate that is slow enough to maintain the electrode close to thermodynamic equilibrium, over a potential range where electroactive species may be oxidized or reduced. The density of reactive sites is obtained from the coulombs of charge passed through the electrode per voltage increment, which is essentially differential capacitance. For most electrodes, interest is primarily in the Faradaic components of the EVS spectra, which exhibit sharp peaks at the electrochemical redox potentials, although non-Faradaic components (such as double-layer or surface capacitance) can also be measured. For nickel electrodes, EVS provides an extremely useful method for probing the phase composition of the active material based on subtle differences in redox potentials. Alternatively, EVS can detect trace levels of electroactive contaminants in nickel-hydrogen cells or nickel electrodes by scanning the potential over the redox range for the contaminant of interest. We will discuss the use of nickel electrode EVS signatures to indicate cobalt additive levels, sinter corrosion, surface changes, double-layer capacitance, electrode swelling, and other factors influencing the performance of the nickel electrode.

DTIC

Spectroscopy; Nickel; Oxidation-Reduction Reactions; Electrochemistry; Electrode Materials

20000032039 Georgia Inst. of Tech., School of Aerospace Engineering, Atlanta, GA USA

Combustion Mechanisms of Heterogeneous Solid Propellants ***Final Report, 1 Mar. 1995-1 Jun. 1999***

Price, E. W.; Chakravarthy, S. R.; Sigman, R. K.; Jeenu, R.; Freeman, J. M.; Feb. 2000; 311p; In English

Contract(s)/Grant(s): N00014-95-1-0559

Report No.(s): AD-A373684; GIT-AER-3; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche

The bulk of the research on this contract was concerned with the mechanisms that cause plateau burning of ammonium perchlorate/hydrocarbon (AP/HC) propellants. The long range goal is to identify the steps in the combustion process that dominate overall burning, and in particular to understand which of these steps in the combustion process lead to plateau burning. Burning alone, matrixes (mixture of binder, fine AP, and catalysts) almost always burn slower than the bimodal propellant at all pressures. The improved burning with a catalyst is probably due to both increased surface layer heat release and to catalytic break down of the large fuel vapor molecules which cause the flame to stand closer to the surface. Deflagration rate of the large AP particles is always lower than the propellant rate, and contributes little to overall rate, except in close proximity to the matrix where a hot stoichiometric diffusion flame occurs and (apparently) supports the marginal matrix burning, accounting for the higher propellant rate. Observations of local intermittency of burning seem to contribute to the low burning rate associated with plateaus and spontaneous quenches.

DTIC

Ammonium Perchlorates; Burning Rate; Diffusion Flames; Solid Propellant Combustion; Solid Propellants; Stoichiometry; Propellant Binders; Composite Propellants; Deflagration

26
METALS AND METALLIC MATERIALS

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

20000030724 NASA Lewis Research Center, Cleveland, OH USA

Directional Solidification of Bi-Sn on USMP-4

Abbaschian, Reza, Florida Univ., USA; deGroh, H., III, NASA Lewis Research Center, USA; Leonardi, E., NASA Lewis Research Center, USA; Timchenko, V., NASA Lewis Research Center, USA; deVahlDavis, G., New South Wales Univ., Australia; [1999]; 12p; In English; 3rd; Solidification and Gravity, Apr. 1999, Hungary; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The experiments used MEPHISTO hardware to study the solidification and melting behavior of bismuth alloyed with 1 at% tin. Three samples, each approximately 900 mm long and 6mm in diameter, were used. A portion of each sample also included a 2 mm diameter growth capillary, to assist in the formation of a single grain. One sample provided the Seebeck voltage generated during melting and freezing processes. Another provided temperature data and Peltier pulsed demarcation of the interface shape

for post flight analysis. The third sample provided resistance and growth velocity measurements, as well as additional thermal data. The third sample was also quenched at the end of the mission to preserve the composition of the liquid near the interface for post flight determination. A total of 450mm of directionally solidified samples were preserved for post mission structural and compositional characterization. Substantial differences were observed in the Seebeck signal between the ground-based experiments and the space-based experiments. The temperature gradient in the liquid for the ground-based experiments was significantly lower than the temperature gradient in the liquid for the space-based experiments.
Author
Directional Solidification (Crystals); Bismuth; Alloying; Tin; Freezing; Melting

20000031653 LaQue Center for Corrosion Technology, Inc., Wrightsville Beach, NC USA
Investigating the Crevice Corrosion Behavior of Coated Stainless Steel in Seawater ***Final Report, 18 Jun. 1997-29 Feb. 00***
Kain, Robert M.; Feb. 2000; 213p; In English
Contract(s)/Grant(s): N00014-97-C-0216
Report No.(s): AD-A373249; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

Normally, stainless steel is utilized without any type of coating whatsoever. However, there are occasions where coatings may be contemplated. One of present interest to the U.S. Navy is that associated with the use of antifouling coatings on ship hulls fabricated of non-magnetic. austenitic stainless steel. Testing in natural seawater has demonstrated that coatings can protect susceptible stainless steel from barnacle related crevice corrosion and localized corrosion at weldments. However, coating defects and damage create new areas for crevice corrosion to initiate. The risk of serious crevice corrosion damage to the substrate increases with the amount of bare metal exposed. Test results demonstrated that just a few square inches of bare stainless steel is sufficient to support the corrosion reactions producing penetrations in excess of 1.5 mm in less than six months. Even 6% Mo alloys are susceptible. Localized corrosion can be prevented by the use of cathodic protection, as demonstrated by testing with sacrificial zinc anodes. However, the apparent degree of polarization associated with zinc anodes may contribute to blistering and disbonding of the coating. Test results indicate that good surface preparation, expectedly, enhances bonding of the coating to the substrate. This degree of preparation also creates more optimum conditions for crevice corrosion propagation at sites which initiate.
DTIC
Antifouling; Stainless Steels; Debonding (Materials); Metal-Water Reactions

20000031718 Department of the Navy, Washington, DC USA
Method for Forming Porous Metals
Everett, Richard K., Inventor; Jul. 27, 1999; 8p; In English; Supersedes US-Patent-Appl-SN-069932
Patent Info.: Filed 30 Apr. 1998; US-Patent-Appl-SN-069,932; US-Patent-5,930,580
Report No.(s): AD-D019526; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A porous material of desired porosity and pore size is made by mixing a particulate material and fungible beads that are thermally decomposable until the desired distribution is attained; compacting the mixed material and beads to form a green body that has sufficient strength to be handled where the beads are undecomposed; and compacting and heating the green body to fuse the material particles and to decompose the beads to gas.
DTIC
Powder Metallurgy; Patents; Porous Materials

20000031748 Department of the Navy, Washington, DC USA
Method and Apparatus for In Situ Measurement of Corrosion in Filled Tanks
Simmonds, Kirth E., Inventor; Batra, narendra K., Inventor; Mignogna, Richard B., Inventor; Aug. 24, 1999; 10p; In English; Supersedes US-Patent-Appl-SN-09053075, AD-D019003.
Patent Info.: Filed 1 Apr. 98,; US-Patent-Appl-SN-09,053,075; US-Patent-5,942,687
Report No.(s): AD-D019536; No Copyright; Avail: US Patent and Trademark Office, Microfiche

An aspect of the present invention is an apparatus for inspecting a base of a liquid filled tank for corrosion, having (a) a housing for use in the liquid filled tank; (b) a set of one or more ultrasonic transducers mounted to the housing, for directing one or more ultrasonic pulses at the base, where the ultrasonic pulses each have a frequency selected to produce a return signal from the base, and for receiving this return signal; and (c) a data capturing system, for storing information from these return signals. Optional features include a second set of one or more ultrasonic transducers for directing one or more ultrasonic pulses at the liquid/gas interface at a frequency selected to produce a return signal from the liquid/gas interface, a data analysis system, a locomotive

system, and a spatial location system. Another aspect of the invention is a method for inspecting a base of a liquid filled tank for corrosion, having the steps (a) directing a broadband ultrasonic pulse at the base from an ultrasonic transducer within the tank, where the ultrasonic pulse includes a resonant frequency for the tank base over the range of expected thicknesses for the base; (b) receiving a return signal with the ultrasonic transducer; (c) performing a Fourier analysis on the return signal to generate a frequency domain signal; and (d) determining the thickness of the base from the frequency domain signal.
DTIC
Corrosion; Storage Tanks; Patents; Data Systems; Ultrasonic Wave Transducers

20000031882 Army Armament Research, Development and Engineering Center, Benet Labs., Watervliet, NY USA
Lead-Tin Solder Characterization by Differential Scanning Calorimetry ***Final Report***
Fleszar, Mark F.; Jan. 2000; 12p; In English; Presented at the 27th North American Thermal Analysis Society Conference, Savannah, GA, 20-23 Sep 99.
Contract(s)/Grant(s): Proj-4EE2B069EH1A
Report No.(s): AD-A373333; ARCCB-TR-00002; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The electrolytic deposition of chromium on the bore of thick-walled, high-pressure cylinders uses a lead-tin alloy as the anode for the plating process. The anode is prepared by melting a lead-tin solder over a cylindrical copper core, which is then machined to the proper diameter. Using differential scanning calorimetry, the melting temperature of various ratios of lead-tin can be measured and a portion of the phase diagram can be established between the solid and liquid states. The melting temperature of a solder can then be measured and the composition can be obtained from the phase diagram.
DTIC
Heat Measurement; Chromium; Copper; Melting

20000031972 National Defence Research Establishment, Avd. foer Vapen och Skydd, Tumba, Sweden
Microstructural Investigation of Penetration Channels in Ti-6Al-4V ***Mikrostrukturell Undersokning av Halkanaler i Ti-6Al-4V***
Petersson, Jenny, National Defence Research Establishment, Sweden; Jun. 1999; 24p; In English
Report No.(s): PB2000-101499; FOA-R-99-01249-318-SE; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy
In this work, an investigation of the microstructure close to the penetration channels in Ti-6Al-4V subjected to ballistic testing has been performed. It is noted that shear bands occur in all samples, including those where the impact velocity of the projectile was too low for the projectile to penetrate the target. Mainly two types of failure are noted, plugging, as a result of the formation of shear bands, and delamination of the target. It is noted that the microstructure seems to play a role in the forming of shear bands.
NTIS
Titanium Alloys; Aluminum Alloys; Penetration; Microstructure; Vanadium Alloys; Failure

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.

20000028402 Technion - Israel Inst. of Tech., Haifa Israel
IMEC-9: The 9th Israel Materials Engineering Conference. Program and Abstracts
Dec. 07, 1999; 269p; In English; 9th; Materials Engineering, 6-7 Dec. 1999, Haifa, Israel
Contract(s)/Grant(s): F61775-00-W-F002
Report No.(s): AD-A373193; EOARD-CSP-00-5002; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche
The Final Proceedings for IMEC-9: The 9th Israel Materials Engineering Conference, 6 December 1999 - 7 December 1999. Metallurgy, Ceramics, composite materials, polymers, electronic materials, characterization methods of materials, modelling, corrosion, energy-related materials, functional materials, bio-materials, high temperature materials, MEMS, Reliability, self assembly, superconductive materials, quasicrystals.
DTIC
Conferences; Refractory Materials; Composite Materials

20000029564 NASA Glenn Research Center, Cleveland, OH USA

A New Apparatus to Evaluate Lubricants for Space Applications: The Spiral Orbit Tribometer (SOT)

Jones, William R., Jr., NASA Glenn Research Center, USA; Pepper, Stephen V., NASA Glenn Research Center, USA; Jansen, Mark J., AYT Corp., USA; Nguyen, QuynhGiao N., AYT Corp., USA; Kingsbury, Edward P., IRC, Inc., USA; Loewenthal, Stuart H., Lockheed Martin Missile and Space, USA; Predmore, Roamer E., NASA Goddard Space Flight Center, USA; March 2000; 12p; In English; 2000 Spring Fuels and Lubricants Meeting and Exposition, 19-22 Jun. 2000, Paris, France; Sponsored by Society of Automotive Engineers, USA

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

Report No.(s): NASA/TM-2000-209935; NAS 1.15:209935; E-12180; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Lubricants used in space mechanisms must be thoroughly tested prior to their selection for critical applications. Traditionally, two types of tests have been used: accelerated and full-scale. Accelerated tests are rapid, economical, and provide useful information for gross screening of candidate lubricants. Although full-scale tests are more believable, because they mimic actual spacecraft conditions, they are expensive and time consuming. The spiral orbit tribometer compromises between the two extremes. It rapidly determines the rate of tribochemically induced lubricant consumption, which leads to finite test times, under realistic rolling/pivoting conditions that occur in angular contact bearings.

Author

Lubricants; Aerospace Engineering; Tribology

20000030723 Colorado School of Mines, Golden, CO USA

Effect of Pigmentation in Particulate Formation from Fluoropolymer Thermodegradation in Microgravity

Srivastava, Rajiv, Colorado School of Mines, USA; McKinnon, J. Thomas, Colorado School of Mines, USA; Todd, Paul, Colorado Univ., USA; 1998; 13p; In English

Contract(s)/Grant(s): NAG3-1685; RTOP 101-12-OA

Report No.(s): AIAA Paper 98-0814; Copyright Waived; Avail: Issuing Activity, Hardcopy

Fires aboard spacecraft have occurred as a result of overheated electrical wires and thermodegradation of their insulation, which is composed of fluoropolymers. The particulate products of polymer thermodegradation are only 20-50 run in diameter and are thought to play a role in ”polymer fume fever”. Therefore an experimental study of the particulates produced by intense ohmic heating of various fluoropolymer-insulated 20 AWG copper wire (representative of spacecraft materials) was undertaken in normal gravity and in microgravity. The 2.2 s drop facility at NASA LeRC and 1.5 s drop facility at the Colorado School of Mines were used to achieve low gravity conditions. Thermophoretic sampling was used for particulate collection. Transmission electron microscopy (TEM) and scanning transmission electron microscopy (STEM) were used to characterize the smoke particulates. It was found that the color of PTFE (Polytetrafluoroethylene) insulation has an overwhelming effect on the size, shape, morphology and, composition of the particulates. Size distributions and shape analyses using computerized image analysis showed that particle size distributions were also dependent on the pigment of the fluoropolymer insulation. The influence of pigment was observed in experiments under both normal and microgravity. Under microgravity conditions, owing to the lack of natural convective transport of particulates, much more particle aggregation was observed, and the nature of the aggregates was dependent on the color of the insulation.

Author

Pigments; Particulates; Polytetrafluoroethylene; Particle Size Distribution; Thermal Degradation; Temperature Effects; Microgravity

20000030737 NASA Langley Research Center, Hampton, VA USA

Hollow Polyimide Microspheres

Weiser, Erik S., Inventor, NASA Langley Research Center, USA; St.Clair, Terry L., Inventor, NASA Langley Research Center, USA; Echigo, Yoshiaki, Inventor, NASA Langley Research Center, USA; Kaneshiro, Hisayasu, Inventor, NASA Langley Research Center, USA; Nov. 30, 1999; 8p; In English

Patent Info.: Filed 21 May 1999; NASA-Case-LAR-15831; US-Patent-5,994,418; US-Patent-Appl-SN-316865; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A shaped article composed of an aromatic polyimide has a hollow, essentially spherical structure and a particle size of about 100 to about 1500 microns, a density of about I to about 6 pounds/ft3 and a volume change of 1 to about 20% by a pressure treatment of 30 psi for 10 minutes at room temperature. A syntactic foam, made of a multiplicity of the shaped articles which are

bounded together by a matrix resin to form an integral composite structure, has a density of about 3 to about 30 pounds/cu ft and a compression strength of about 100 to about 1400 pounds/sq in.
Official Gazette of the U.S. Patent and Trademark Office
Resins; Polyimides; Composite Structures; Compressive Strength; Aromatic Compounds

20000031340 Dayton Univ., OH USA
Biodegradation of Polymeric Coatings and Corrosion of Aircraft Materials ***Final Report, 1 Apr.-31 Oct. 1998***
Trick, Kimberly A.; Jul. 07, 2000; 8p; In English
Contract(s)/Grant(s): F49620-98-1-0297
Report No.(s): AD-A373562; AFRL-SR-BL-TR-00-0033; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

During the reporting period, FY 99, substantial progress was made toward modifying an instrumentation design that will allow micro study of biodegradation and corrosion mechanisms. A Quartz Electrochemical Micro Balance (QEMB) system has been designed and six systems have been constructed and calibrated. These units will be interfaced with a data acquisition system to monitor reactions and study degradation mechanisms of polymeric coatings in a variety of biological environments.
DTIC
Biodegradation; Polymeric Films; Corrosion; Aircraft Equipment; Data Acquisition

20000031392 NASA Ames Research Center, Moffett Field, CA USA
High Temperature Resistant Organopolysiloxane Coating for Protecting and Repairing Rigid Thermal Insulation
Leiser, Daniel B., Inventor, NASA Ames Research Center, USA; Hsu, Ming-Ta S., Inventor, NASA Ames Research Center, USA; Chen, Timothy S., Inventor, NASA Ames Research Center, USA; Nov. 16, 1999; 10p; In English
Patent Info.: Filed 13 Mar. 1997; NASA-Case-ARC-14077-1; US-Patent-5,985,433; US-Patent-Appl-SN-823665; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Ceramics are protected from high temperature degradation, including high temperature, oxidative, aeroconvective degradation by a high temperature and oxidation resistant coating of a room temperature curing, hydrolyzed and partially condensed liquid polyorganosiloxane to the surface of the ceramic. The liquid polyorganosiloxane is formed by the hydrolysis and partial condensation of an alkyltrialkoxysilane with water or a mixture of an alkyltrialkoxysilane and a dialkyldialkoxysilane with water. The liquid polyorganosiloxane cures at room temperature on the surface of the ceramic to form a hard, protective, solid coating which forms a high temperature environment, and is also used as an adhesive for adhering a repair plug in major damage to the ceramic. This has been found useful for protecting and repairing porous, rigid ceramics of a type used on reentry space vehicles.
Author
High Temperature; Thermal Resistance; Polysiloxanes; Thermal Insulation

20000031681 Media and Process Technology, Inc., Pittsburgh, PA USA
A Low Cost Environmentally Benign Waste Lubricants Recycling/Re-refining Technology ***Final Report, 30 Jun. 1997-31 Mar. 1999***
Liu, Paul T.; Ciora, RIchard J., Jr.; May 1999; 41p; In English
Contract(s)/Grant(s): F33615-97-D-2776; AF Proj. 3048
Report No.(s): AD-A373428; AFRL-PR-WP-TR-1999-2040; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Over two million gallons of spent aviation turbine lubricants are generated in the U.S. by the Department of Defense and the commercial airlines. Media and Process Technology Inc. has developed the membrane-based process which can re-refine the spent turbine oil to near virgin state. This report summarized the results obtained from a pilot demonstration unit. About 300 gallons of finished product were produced and was sent to the customers for initial market testing. Based upon the positive response from the process and market testing conducted in this project, a full scale production facility will be pursued as a next step for commercialization.
DTIC
Waste Disposal; Lubricants; Oils; Recycling; Waste Utilization; Low Cost

20000031728 Department of the Navy, Washington, DC USA
Process for Preparing a Vinyl Terminated Polymer
Talukder, Mostafa A., Inventor; Sep. 14, 1999; 3p; In English
Patent Info.: Filed 24 Sep. 98,; US-Patent-Appl-SN-09,168,332; US-Patent-5,952,458
Report No.(s): AD-D019570; No Copyright; Avail: US Patent and Trademark Office, Microfiche

This invention discloses synthesis of a vinyl terminated polymer by reacting a cationically polymerizable monomer in the form of a cyclic ether with an acid chloride in a suitable solvent and in the presence of a Lewis acid. The vinyl-terminated polymers can be polymerized with other appropriate monomers resulting in thermoplastic elastomers having suitable properties for use as binders for explosives and propellants.
DTIC
Elastomers; Vinyl Polymers; Inventions; Patents

20000031738 Office of the Under Secretary of Defense (Acquisitions and Technology), Washington DC, Washington, DC USA
Assessing Industrial Capabilities for Carbon Fiber Production
Traceski, Frank T.; Jan. 1999; 16p; In English
Report No.(s): AD-A372856; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Analysis and evaluation of requirements and industrial capabilities are an important part of the defense system acquisition process. From providing milestone decision support on industrial and production issues to understanding and managing program risk, assessment of industrial capabilities provides for informed and realistic decision making on major defense acquisition programs. Carbon fiber is a key constituent of advanced composite materials used in many defense and aerospace systems. This paper assesses industrial capabilities for carbon fiber production, a sub-tier industrial sector critical to defense systems.
DTIC
Carbon Fibers; Aerospace Systems; Decision Making

20000031744 Department of the Navy, Washington, DC USA
Wet-Spinning Fiber Process Providing Controlled Morphology of the Wet-Spun Fiber
Buckley, Leonard J., Inventor; Eashoo, Mark, Inventor; Aug. 17, 1999; 4p; In English; Supersedes US-Patent-Appl-SN-800328
Patent Info.: Filed 14 Feb. 1997; US-Patent-Appl-SN-800,328; US-Patent-5,938,999
Report No.(s): AD-D019530; No Copyright; Avail: US Patent and Trademark Office, Microfiche
A wet spinning fiber process which controls the microstructure of the wet spun fiber by varying the non-solvent/solvent miscibility and precipitation strength.
DTIC
Patents; Microstructure; Solubility; Printed Circuits; Polyimides

20000031767 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
Design of a Resistive Susceptor for Uniform Heating During Induction Bonding of Composites ***Final Report, Oct. 1996-Sep. 1997***
Fink, Bruce K.; Yarlagadda, Shridhar; Gillespie, John W., Jr; Jan. 2000; 45p; In English; Prepared in cooperation with the Composite Materials Research Program at the University of Delaware, Newark, DE 19716.
Report No.(s): AD-A373381; ARL-TR-2148; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
A novel susceptor concept for metal-mesh susceptors, designed to achieve uniform in-plane temperatures during induction heating, is documented. The process involves redirecting eddy-current flow patterns in the resistive-mesh susceptor by specifically designed cut patterns in the mesh. A theoretical model was developed to predict heat generation in metal-mesh susceptors with any described network pattern. initial results for cut patterns show significant changes in heating compared to an uncut mesh. Cut patterns can be optimized to reduce temperature gradients in the susceptor to within the processing window of the composite. Experimental results are presented for qualitative comparisons.
DTIC
Composite Materials; Mathematical Models; Temperature Gradients; Thermoplastic Resins; Bonding

20000031871 National Inst. for Fusion Science, Toki, Japan
Condensation and Swelling Behavior of Randomly Charged Multichain Polymers by Molecular Dynamics Simulations
Tanaka, Motohiko, National Inst. for Fusion Science, Japan; Grosberg, A. Yu, Minnesota Univ., USA; Tanaka, Toyoichi, Massachusetts Inst. of Tech., USA; December 1999; ISSN 0915-633X; 32p; In English; Original contains color illustrations
Report No.(s): NIFS-616; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The behavior of polyampholytes over a wide range of temperatures is studied with the use of molecular dynamics simulations. It has been found that biased fluctuations of charge density due to aggregation of oppositely charged monomers causes the Coulombic interactions more attractive than repulsive for a globally near-neutral polyampholyte. Such a polyampholyte collapses to a globule, in which the polymer chains inter-penetrate with each other and reptate through the whole globule. It further condenses to an NaCL-like cubic crystal for widely extensible chains, but crystallization is suppressed for finite extensible chains.

Hysteresis in the volume-temperature diagram is prominent for multichain polyampholytes, which is absent for individual chains. Multichain effects always dominate over the single-chain effects in swelling processes of polyampholytes. A non-neutral polyampholyte still forms a globule if the amount of charge offset is less than 1/2 N(exp 1/2) (N: the number of charged monomers) at low temperatures. Otherwise, it consists of scattered chains and is swollen. At high temperatures, it shrinks to the thermal state where the Coulomb force plays little role. A polyampholyte with slight charge offset has a non-monotonic (re-entrant) phase boundary with temperature. These results in the temperature domain are in good agreement with polyampholyte experiments with variable salt concentrations.
Author
Condensation; Swelling; Molecular Chains; Polymers; Simulation; Molecular Dynamics; Temperature Effects

20000031880 Department of the Navy, Washington, DC USA
Direct Molecular Patterning Using a Micro-Stamp Gel
Turner, David C., Inventor; Martin, Brett, Inventor; Gaber, Bruce P., Inventor; Sep. 07, 1999; 13p; In English; Supersedes US-Patent-Appl-SN-08940178, AD-D018628.
Patent Info.: Filed 30 Sep. 97,; US-Patent-Appl-SN-08,940,178; US-Patent-5,948,621
Report No.(s): AD-D019560; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A stamp for transferring molecules and molecular patterns to a substrate surface includes a backing and a polymeric gel hound to the hacking and loaded with the a molecular species. Where the molecule to be patterned is a biomolecule, such as a protein or nucleic acid, the polymeric gel is typically a hydrogel. Exemplary hydrogels include sugar-based polyacrylates and polyacrylamides.
DTIC
Immunoassay; Patents; Inventions

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.

20000028397 British Petroleum Co. Ltd., Amoco Oil, Sunbury-on-Thames, UK
Design and Current Status of Development of a Jet Fuel Thermal Stability Additive
Taylor, Spencer E., British Petroleum Co. Ltd., UK; Sep. 10, 1999; 10p; In English
Report No.(s): AD-A373364; ISABE-99-7276; Copyright; Avail: Defense Technical Information Center (DTIC)

An initiative led by the US Air Force concluded that advances in military fighter aircraft systems would require fuels with over 50% improvement in heat sink capability over conventional JP8 fuel. This led to the creation of the ”JP8+100” program during which hundreds of commercial additives were tested for thermal stability enhancing characteristics. The program demonstrated that the thermal stability of jet fuels (particularly JPS) could be enhanced through the use of particular additives and additive blends used at relatively low concentrations. Additionally, flight testing highlighted a significant reduction in fuel- and related maintenance costs, arising from cleaner combustion. One aspect of the incorporation of the most beneficial additives from a thermal stability viewpoint that has given some cause for concern, however, is the consequent effect on the water and solids separation from ”JP8+100” fuel, a feature minimized by introduction of the ”+100” additive as close to the skin of the aircraft as possible. Inspired by the USAF success, and anticipated consequential environmental benefits, we have conducted an experimental program for the design and development of a conceptually new multifunctional molecular species to enhance the thermal stability of jet fuels, without compromising other required essentials of jet a fuel product quality.
DTIC
Jet Engine Fuels; Additives; Thermal Stability; Flight Tests

20000029419 Johns Hopkins Univ., Chemical Propulsion Information Agency, Columbia, MD USA
JANNAF 35th Combustion Subcommittee Meeting, Volume 1
Fry, Ronald S., Editor, Johns Hopkins Univ., USA; Gannaway, Mary T., Editor, Johns Hopkins Univ., USA; Rognan, Melanie, Editor, Johns Hopkins Univ., USA; December 1998; 468p; In English; 35th; Combustion, 7-11 Dec. 1998, Tucson, AZ, USA; Sponsored by NASA, USA; See also 20000029420 through 20000029455
Contract(s)/Grant(s): SPO700-97-D-4004

Report No.(s): CPIA-Publ-680-Vol-1; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Volume 1, the first of two volumes is a compilation of 63 unclassified/unlimited distribution technical papers presented at the 35th meeting of the Joint Army-Navy-NASA-Air Force (JANNAF) Combustion Subcommittee (CS) held jointly with the 17th Propulsion Systems Hazards Subcommittee (PSHS) and Airbreathing Propulsion Subcommittee (APS). The meeting was held on 7-11 December 1998 at Raytheon Systems Company and the Marriott Hotel, Tucson, AZ. Topics covered include solid gun propellant processing, ignition and combustion, charge concepts, barrel erosion and flash, gun interior ballistics, kinetics and molecular modeling, ETC gun modeling, simulation and diagnostics, and liquid gun propellant combustion; solid rocket motor propellant combustion, combustion instability fundamentals, motor instability, and measurement techniques; and liquid and hybrid rocket combustion.

Author

Propellant Combustion; Gun Propellants; Interior Ballistics; Hazards; Solid Propellant Ignition; Solid Propellant Rocket Engines; Conferences

20000029424 Herman (Gerald J.), Farmington Hills, MI USA

Approach, Implementation, and Verification of a Solid Propellant Gas Generator Simulation

Herman, Gerald J., Herman (Gerald J.), USA; JANNAF 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 321-331; In English; See also 20000029419

Contract(s)/Grant(s): TDS-15213; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

The development, implementation and verification of a general-purpose computer code to be used for ”what if” calculations of gas generator characteristics is described. The gas generator is subdivided into individual segments to accommodate arbitrary spatial configurations in 0, 1, and 2 dimensions. The approach to ignition, dynamic burn, and extinction of the solid propellant are unique. Comparisons are made between test and simulation results. Preliminary results suggest this easy-to-use, rapidly executing code provides useful and accurate predictions.

Author

Gas Generators; Solid Propellants; Computerized Simulation; Mathematical Models; Solid Propellant Ignition; Propellant Combustion

20000029427 Murray State Univ., Dept. of Physics and Engineering Physics, KY USA

Laser Recoil Response of AP/HTPB Propellants at 1 to 5 ATM

Hickman, S. R., Murray State Univ., USA; Brewster, M. Quinn, Illinois Univ., USA; JANNAF 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 363-373; In English; See also 20000029419

Contract(s)/Grant(s): N00014-95-1-1339; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

The combustion of HTPB propellants containing fine AP was investigated using a variety of methods including the laser-driven, combustion recoil technique at 1 to 5 atm, undriven combustion recoil measurements at 1 atm, and microthermocouples. At 1 atm, binder-rich (70 to 75% AP), monomodal fine-AP propellants exhibit a prominent secondary (non-QSHOD) laser-driven response peak at 100 to 300 Hz, depending on AP size, whereas bimodal (nearly stoichiometric) propellants exhibit no such secondary response. Raising the pressure to 2 atm causes the secondary response frequency to increase to around 650 Hz in the binder-rich, monomodal fine-AP propellants, while in the bimodal propellants the higher pressure causes the secondary response (absent at 1 atm) to begin to appear, at about the same frequency, 650 Hz. Undriven combustion recoil measurements at 1 atm showed spontaneous oscillatory combustion in the binder-rich, monomodal, fine-AP formulations at frequencies comparable to the secondary response peak in laser-driven tests. Microthermocouple measurements also exhibited self-oscillatory temperature profiles in the gas phase for the binder-rich, fine-AP formulations with the same frequency as the spontaneous recoil. This oscillatory combustion behavior is attributed to selective or disproportionate pyrolysis of AP and HTPB, the resulting unsteady accumulation and depletion of AP at the propellant surface, and the associated compositional (stoichiometric) fluctuations that occur in the gas phase reaction zone.

Author

Solid Propellant Combustion; Aluminum Perchlorates; Pyrolysis; Stoichiometry; HTPB Propellants; Spontaneous Combustion

20000029428 Pennsylvania State Univ., Dept. of Mechanical and Nuclear Engineering, University Park, PA USA

Comparison of Laser and Pressure-Driven Thrust Measurements for Solid Propellants

Kudva, Gautam N., Pennsylvania State Univ., USA; Lee, Young-Joo, Pennsylvania State Univ., USA; Tang, Ching-Jen, Pennsylvania State Univ., USA; Litzinger, Thomas A., Pennsylvania State Univ., USA; JANNAF 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 375-386; In English; See also 20000029419

Contract(s)/Grant(s): N00014-95-1-1338; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Unsteady thrust response of two propellants, formulated for studies of motor stability, was measured during laser and pressure-driven combustion. A CO2 laser was used as a heating source to ignite and sustain the propellant combustion during pressure-driven tests by providing a constant heat flux. The laser acted as a source of ignition and oscillatory heat flux during laser-driven combustion. The laser-driven tests were performed at frequencies ranging from 3.9 to 250 Hz. Mean incident laser heat fluxes of 35 and 60 were used. Pressure-driven thrust measurements were made in a different chamber with a 10% peak-to-peak pressure variation of the mean. The driving frequencies ranged from 4 to 100 Hz. Tests were conducted with air as the ambient gas at atmospheric pressure. The thrust response amplitude and phase as a function of frequency and heat flux were collected under both test conditions.

Author

Solid Propellant Combustion; Thrust Measurement; Pressure Oscillations; Laser Applications; Burning Rate

20000029429 Pennsylvania State Univ., Dept. of Aerospace Engineering, University Park, PA USA

Magnetic Flowmeter Measurements of Pressure-Coupled Responses of Several Non-Aluminized Plateau Propellants

Cardiff, Eric H., Pennsylvania State Univ., USA; Pinkham, J., Pennsylvania State Univ., USA; Saretto, S., Pennsylvania State Univ., USA; Shinohara, K., Pennsylvania State Univ., USA; Micci, Mike M., Pennsylvania State Univ., USA; JANNAF 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 387-396; In English; See also 20000029419; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

The objective of this work was to use the magnetic flowmeter to measure and compare the pressure-coupled responses of several non-aluminized propellants. Pressure-coupled response functions were taken for three different Thiokol AP-HTPB based reduced smoke propellant formulations with a magnetic flowmeter combustion chamber. An acoustic wave is produced inside of the chamber by means of a gear rotating above the exhaust nozzle, while the magnetic flowmeter obtains a measurement of the oscillatory gas velocity. These measurements were taken in conjunction with a measurement of the oscillatory pressure and of the propellant burning surface position. An acoustic analysis was performed on these measurements to obtain a value for the characteristic acoustic admittance and pressure-coupled response of the propellant. Results were obtained at frequencies between 300 and 2000 Hz and at pressures of 300 psi and 1000 psi. The response peak was a higher magnitude and at a higher frequency for the propellant which used an IPDI curative instead of the baseline DDI curative. The response peak was lower and at a lower frequency for the propellant with a higher coarse to fine AP ratio.

Author

Pressure Measurement; Flowmeters; Metal Propellants; Solid Propellant Combustion; Sound Pressure

20000029430 Naval Air Warfare Center, Research and Technology Group, China Lake, CA USA

MHD T-Burner Combustion Response of AP/HTPB Formulations at 300 and 1000 psi

Finlinson, Jerry C., Naval Air Warfare Center, USA; Blomshield, Fred S., Naval Air Warfare Center, USA; Stalnaker, Richard, Naval Air Warfare Center, USA; JANNAF 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 397-405; In English; See also 20000029419; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

MHD (magneto hydro dynamic) instrumentation was installed on the 36 inch T-burner for simultaneous measurements of pressure coupled response and MHD velocity field oscillation measurements. Tests have been done at pressures of 200, 300, and 1000 psia using pellets of AP, HMX, and RDX and AP/HTPB propellants BP4, 3%HMX and 3%UFAL. This year a 4000 gauss permanent magnet was obtained, it was hoped that it would produce larger MHD electrode voltages. Autolite sparkplugs were used as the electrodes on several tests. Probe 1, nearest the sample, generally had the highest signal levels, but not the same frequency as the pressure oscillation. Oscillation levels were strongest for the AP pellets. It was expected that the phase lags for the probes would be closer together than they were.

Author

Solid Propellant Combustion; Magnetohydrodynamics; Pressure Oscillations; HTPB Propellants; Propellant Chemistry; Rocket Oxidizers; Pressure Measurement; Aluminum Perchlorates

20000029431 Alabama Univ., Propulsion Research Center, Huntsville, AL USA

Experimental Determination of Pressure Coupled Response Functions

DiSalvo, R., Alabama Univ., USA; Frederick, Robert A., Alabama Univ., USA; Moser, Marlow D., Alabama Univ., USA; JANNAF 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 407-414; In English; See also 20000029419

Contract(s)/Grant(s): N00014-95-1-1338; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

This experimental study provides an initial evaluation of directly measuring values of the pressure coupled response functions of solid propellant. A pressure-modulated combustion bomb drove the combustion of end-burning AP/HTPB propellant samples. A rotating valve modulated the injection of nitrogen into a vented chamber at 10-12 Hz. A pulse-echo ultrasonic measurement system determined the surface position of the burning propellant at 5000 samples per second. The resulting burning rate and pressure data as a function of time provided the basis for determining values of the pressure-coupled response function. At a mean pressure of 1000 psi with an 80 psi peak-to-peak oscillation, the value of the response is 1.17 for a propellant having a pressure exponent of 0.88. The result at 675 +/- 30 psi is a response function value of 0.85 at 10 Hz and pressure exponent of 0.56. For the 230 +/- 20 psi case there is a response function value of 1.4 at 11 Hz compared with a pressure exponent of 0.21. The dispersion of the response function values is from 25-50% from the average values. The work demonstrates the potential utility of cold gas injection and ultrasonics for making direct measurements of the pressure-coupled response function. Recommendations include strategies for increasing the measurement resolution and frequency range of the technique.

Author

Solid Propellants; Solid Propellant Combustion; Burning Rate; Pressure Oscillations

20000029432 Brigham Young Univ., Provo, UT USA

Modeling Pressure and Heat Flux Responses of Nitramine Monopropellants with Detailed Kinetics

Erikson, William W., Brigham Young Univ., USA; Beckstead, Merrill W., Brigham Young Univ., USA; JANNAF 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 415-434; In English; See also 20000029419

Contract(s)/Grant(s): N00014-95-1-1338; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

A numerical model of unsteady solid monopropellant combustion has been developed. The model supersedes previous work by allowing the calculation of (1) steady state, (2) quasi-steady gas phase, and (3) fully unsteady gas phase within the framework of a single code. Code improvements allowed for a substantial decrease in the required CPU time and yield increased accuracy over the previous model. AD features of the previous model were maintained, including a detailed elementary gas phase reaction mechanism, condensed phase decomposition, surface evaporation and in-depth absorption of thermal radiation. Application was made to the cyclic nitramines, RDX and HMX, using a detailed chemical reaction mechanism. The model was used to simulate the burn rate responses to oscillating pressure and laser heat flux inputs. Results compare reasonably well with available experimental response data as well as traditional theoretical work. In addition, the validity of the commonly used quasi-steady assumption is examined by comparing code results for quasi-steady calculations with corresponding fully unsteady cases. Evidence is given for significant discrepancies at relatively low frequencies-particularly for high pressure conditions.

Author

Combustion Stability; Solid Propellant Combustion; Mathematical Models; Monopropellants; Chemical Reactions; Heat Flux; Pressure Oscillations

20000029433 Talley Defense Systems, Mesa, AZ USA

ZN Method Extensions

Ludwig, C. Ludwig, Talley Defense Systems, USA; Lee, W. Y., Talley Defense Systems, USA; Glick, Robert L., Talley Defense Systems, USA; JANNAF 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 435-443; In English; See also 20000029419

Contract(s)/Grant(s): N00014-95-1-1339; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Analysis of ZN's R(p) expression's error propagation characteristics shows accurate, explicit nonsteady predictions cannot be based solely on steady state data. An implicit approach based on steady and oscillatory state data 4) CL is described and preliminary results presented. Variable property, condensed phase reactivity, and structural/deflagration interaction ZN extensions are briefly examined. It is tentatively concluded that ZN can be extended to include variable properties and

structural/deflagration interactions. Unfortunately, data requirements for including strong condensed phase reactivity are probably impractical. Challenges are illuminated.
Author
Solid Propellant Combustion; Combustion Stability; Mathematical Models; Deflagration; Error Analysis; Steady State; Prediction Analysis Techniques

20000029435 California Inst. of Tech., Pasadena, CA USA
Stability Analysis and Combustion Modeling of AP Composite Propellants
Roh, Tae-Seong, California Inst. of Tech., USA; Cohen, Norman S., Cohen (Norman S.) Professional Services, Inc., USA; Beddini, Robert A., Illinois Univ. at Urbana-Champaign, USA; Culick, Fred E. C., California Inst. of Tech., USA; JANNAF 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 459-462; In English; See also 20000029419
Contract(s)/Grant(s): N00014-95-1-1338; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

A model for the combustion of ammonium perchlorate composite propellants has been incorporated into a comprehensive gas dynamics model of solid rocket motor flow fields. Initial results are presented for steady state conditions. Current work is developing a non-steady version of this model, including the heterogeneous combustion and turbulence mechanisms, for application to nonlinear combustion instability analyses. This paper describes the essential mechanisms and features of the model and reviews effects of AP particle size on combustion response in terms of classical response function theory.
Author
Combustion Stability; Ammonium Perchlorates; Composite Propellants; Gas Dynamics; Solid Propellant Rocket Engines; Stability Tests; Solid Propellant Combustion; Turbulent Combustion

20000029438 Tennessee Univ., Tullahoma, TN USA
Origins of Linear Velocity Coupling
Flandro, G. A., Tennessee Univ., USA; JANNAF 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 485-495; In English; See also 20000029419
Contract(s)/Grant(s): N00014-95-1-1338; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

A multitude of experiments confirm that there are important differences in apparent combustion response brought about when wave motion is parallel to rather than perpendicular to a burning surface. This effect is traditionally attributed to velocity coupling defined as the unsteady boundary response to interactions between the axial acoustic ”cross-flow” velocity and combustion processes. Interpretation of experimental data has been hampered by lack of a cohesive analytical framework for this problem. Without a valid model, it is impossible to deduce numerical values for use in predictive stability assessment codes such as the Standard Stability Prediction Program (SSPP). A major difficulty is the close interrelationship between velocity coupling and other effects of parallel wave incidence that have also lacked a firm analytical foundation. of dim the most important is the flow-turning in this paper capitalizes on the detailed understanding of the flow-turning mechanism that has recently been achieved. An analytical approach inspired by the success with flow-turning is utilized in this paper to bring the physical details of velocity coupling into focus. Velocity coupling is demonstrated to be the composite of several processes that involve production of both steady and unsteady vorticity at the burning surface. In the burning zone, the vorticity is closely tied to pressure gradients within the burning zone and parallel to the surface. These am absent when waves impinge normally on the surface, and they account for the modifications within the combustion zone that lead to velocity coupling. The resulting model is similar in many ways to the velocity coupling anticipated in earlier works, and provides a useful way to include velocity coupling in predictive calculations in a rational manner. However, velocity coupling attributes related to the effects of rectification and erosive burning require evaluation of nonlinear and turbulent interactions. Work is now underway to provide these extensions for use in an improved version of the SSPP.
Author
Solid Propellant Combustion; Combustion Physics; Erosive Burning; Acoustic Velocity; Velocity Coupling; Boundary Layer Combustion; Unsteady Flow

20000029443 Illinois Univ. at Urbana-Champaign, Dept. of Aeronautical and Astronautical Engineering, Urbana, IL USA
The Threshold Condition of Propellant Velocity Response and its Relation to Local Turbulent Transition
Beddini, Robert A., Illinois Univ. at Urbana-Champaign, USA; Lee, Yong-Ho, Illinois Univ. at Urbana-Champaign, USA; JANNAF 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 541-547; In English; See also 20000029419

Contract(s)/Grant(s): N00014-95-1-1338; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

The nonlinear stability theories being developed for solid propellant rockets require and depend strongly a velocity response function. Prior work by the author has shown, through computational solutions of a turbulence and combustion model, that a significant source of response to solid rocket aeroacoustics can result from the interaction between acoustically-induced turbulence and combustion processes. The objective of the present investigation is to address prediction of the threshold condition of propellant response to a crossflow, as doing so may allow avoidance of unstable operating regimes. The threshold behavior involves transition from near-laminar to a turbulent flow as a prerequisite condition, and is thus a problem of hydrodynamic instability. In the present approach, linear stability theory is used to obtain unstable flow regimes. Preliminary results are obtained for benchmark problems involving steady injection-induced flow, and oscillatory and modulated noninjected duct flows. The present results compare favorably with prior theoretical and experimental results. It is also shown that the growth rates from the linear stability equations can display nonlinear, harmonic behavior for purely oscillatory flows, and that highly amplified disturbance 'bursts" can occur during parts of the cycle.

Author

Combustion Physics; Turbulent Combustion; Solid Propellant Combustion; Combustion Stability; Velocity Distribution; Cross Flow; Steady Flow

20000031335 Coordinating Research Council, Inc., Atlanta, GA USA

Development of a Test Method for the Determination of the Hydroperoxide Potential and Antioxidant Effectiveness in Jet Fuels During Long Term Storage ***Final Report, 1 Jun. 1994-1 MAr 1999***

Sep. 1999; 51p; In English

Contract(s)/Grant(s): F33615-94-C-2401; AF Proj. 3048

Report No.(s): AD-A373517; CRC-614; AFRL-PR-WP-TR-1999-2119; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A reliable test method is needed for predicting the long term storage stabilities of military aviation turbine fuel reserves as well as for evaluating the effectiveness of antioxidants approved for these fuels. This report addresses this need. It describes a reliable and practical accelerated test method for predicting the peroxidation potential of aviation turbine fuels that are stored for long term periods. A test methodology is also proposed for evaluating antioxidants for future qualification in the military specification, MIL-T-5624. This paper is based on the collective results of extensive rigorous studies performed by the four participating laboratories: Southwest Research Institute (SwRI), San Antonio, Texas; Naval Research Laboratory (NRL) Washington, D.C.; Naval Air Warfare Center (NAWC), Trenton, New Jersey; and the National Institute of Petroleum and Energy Research (NIPER), Bartlesville, Oklahoma.

DTIC

Jet Engine Fuels; Antioxidants; Storage; Materials Handling

20000031647 Coordinating Research Council, Inc., Atlanta, GA USA

The Effect of Stadis 450 on MSEP Rating and Coalescence Technical Basis of Re-Doping Turbine Fuels With Stadis 450 ***Final Report, 1 Jun. 1994-1 Mar. 1999***

Sep. 1999; 29p; In English

Contract(s)/Grant(s): F33615-94-C-2401; AF Proj. 3048

Report No.(s): AD-A373482; CRC-601; AFRL-PR-WP-TR-1999-2118; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The use of filter/coalescers at airports and terminals requires that the fuel be free from additives and contaminants which might reduce the effective service life of these elements. The Microseparometer (MSEP) is one test which is commonly used to ensure that the fuel is free from surfactants. However, experience has shown that the use of Stadis 450 often significantly lowers MSEP rating while not affecting coalescer performance. This has caused problems in situations where re-doping with Stadis 450 to improve the fuel conductivity is needed. In some cases, the MSEP rating due to previous additions of Stadis 450 precludes re-doping without reducing the MSEP to below commonly accepted ratings. This study was undertaken to determine whether there was a correlation between the MSEP rating due to Stadis 450 addition and coalescer deactivation. Examination of data from field experience, the USA Air Force service tests, and other literature confirmed the hypothesis that Stadis 450 did not adversely affect coalescer performance commensurate with the drop in MSEP rating often seen. A substantial experimental evidence from single element tests similar comparing coalescer performance when ASA-3 was used to those tests when Stadis 450 was used showed slightly better effluent water levels when Stadis 450 was used (3.9 ppm for ASA-3 vs. 2.9 ppm), while the average value of MSEP differed markedly (88.7 for ASA-3 vs. 63 for Stadis 450). As a result of this study, it was concluded that the customary

minimum MSEP of 70 can be relaxed when a drop in rating is specifically due to the addition of Stadis 450. The data indicate that Stadis 450 will not disarm coalescers even though MSEP may be low. However, there is a need to maintain control over chance contamination which may occur during fuel handling and distribution which could have a deleterious effect on coalescence.
DTIC
Additives; Contaminants; Surfactants; Contamination; Coalescing

20000031686 Pennsylvania State Univ., University Park, PA USA
Fuel Stabilization ***Final Report, 1 Jul. 1995-31 Dec. 1998***
Coleman, Michael M.; Fearnley, Steven P.; Kumar, Sanat; Sobkowiak, Maria; Sep. 1999; 49p; In English
Contract(s)/Grant(s): F33615-98-D-2802; AF Proj. 3048
Report No.(s): AD-A373390; AFRL-PR-WP-TR-2000-2007; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The primary objectives of Delivery Order 0001 were threefold. The first was a fundamental study of high-temperature fuel stabilization performed to assess the practical temperature limits of hydrogen-donor stabilization. The second was an experimental study carried out to determine whether superior hydrogen-donor stabilizers could be designed and synthesized. The third was a study performed to determine the vulnerability of high-temperature hydrogen-donor stabilizers to oxidative degradation in the autoxidative temperature regime. Delivery Order 0001 consisted of three tasks: Fundamentals of High-Temperature Stability, Design of Superior Stabilizers, and Low-Temperature Oxidation Resistance of Thermal Stabilizers. The results are presented in Sections 2.0, 3.0, and 4.0, respectively; Section 5.0 contains references.
DTIC
Fuels; High Temperature Gases; Degradation; Stabilization

20000031713 Department of the Navy, Washington, DC USA
Cure Shrinkage Measurement
Byrd, Stanley G., Inventor; Swett, Herbert M., Inventor; Jul. 27, 1999; 5p; In English; Supersedes US-Patent-Appl-SN-08/914012
Patent Info.: Filed 23 Jul. 1997; US-Patent-Appl-SN-914,012; US-Patent-5,928,545
Report No.(s): AD-D019520; No Copyright; Avail: US Patent and Trademark Office, Microfiche

The apparatus and method measures the shrinkage of rocket motor propellant that is caused during curing and may control this shrinkage by thermally expanding it to prevent creation of voids and cracks. The apparatus heats the propellant compound during curing. A laser emits radiation onto the compound and a detector receives reflected radiation from the compound and provides signals representative of the size of the volume of the compound. An interconnected indicator provides readouts representative of the size. A temperature controller coupled to a processor and a heater controls the heating of the compound to regulate its thermal expansion and consequent volume. The method calls for heating the compound during curing and radiating it with a laser. Reflected radiation is detected to provide signals representative of the volume. Readouts of the signals represent the relative size of the compound. The signals may be used to control a heater that supplies heat to correspond the compound's curing shrinkage to thermal expansion during the curing process to prevent the creation of voids and cracks. These signals also may be used to control curing in a production oven of other rocket motors made from the same or similar batches of propellant compound.
DTIC
Rocket Propellants; Patents; Curing; Rocket Engines; Laser Beams

20000031739 Parsons Engineering Science, Inc., Denver, CO USA
Intrinsic Remediation Engineering Evaluation/Cost Analysis for the FT-OO2 Site Final Addendum II ***Final Report***
Oct. 1999; 69p; In English
Report No.(s): AD-A372861; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report was prepared for the Air Force Center for Environmental Excellence (AFCEE) by Parsons Engineering Science, Inc. (Parsons ES) as a second addendum (Addendum II) to the Final Intrinsic Remediation Engineering Evaluation/Cost Analysis (EE/CA) (Parsons ES, 1995). The EE/CA was conducted to evaluate the use of natural attenuation with long-term monitoring (LTM) for remediation of fuel hydrocarbons dissolved in groundwater at site FT-002, Plattsburgh Air Force Base (AFB), New Y%rk. The report also provided an assessment of the concentration and distribution of chlorinated aliphatic hydrocarbons (CAHs) dissolved in groundwater.
DTIC
Water Pollution; Chlorocarbons; Hydrocarbons

20000031885 Department of the Navy, Washington, DC USA

Non-Toxic Hypergolic Miscible Bipropellant

Rusek, John J., Inventor; Anderson, Nicole, Inventor; Lormand, Bradley M., Inventor; Purcell, Nicky L., Inventor; Aug. 03, 1999; 4p; In English

Patent Info.: Filed 22 Dec. 97,; US-Patent-Appl-SN-08,999,059; US-Patent-5,932,837

Report No.(s): AD-D019553; No Copyright; Avail: US Patent and Trademark Office, Microfiche

The non-toxic bipropellant of the present invention contains a non-toxic hypergolic miscible fuel (NHMF) and a rocket grade hydrogen peroxide. This non-toxic hypergolic miscible fuel (NHMF) has rapid ignition capability. The non- toxic hypergolic miscible fuel (NHMF) contains 3 species. Namely, a polar organic species miscible with hydrogen peroxide, a propagator, which may be substituted or unsubstituted amines, amides or diamines, and an inorganic metal salt, which reacts to form a catalyst in solution or as a colloid. The inorganic metal salt is miscible with the polar organic species and the propagator in solution. The catalyst has a faster rate of reaction with said rocket grade hydrogen peroxide than the propagator, the propagator has a faster rate of reaction with the rocket grade hydrogen peroxide than the polar organic species, and the polar organic species, propagator and catalyst are mutually soluble.

DTIC

Patents; Liquid Rocket Propellants; Reaction Kinetics

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.

20000030678 NASA Glenn Research Center, Cleveland, OH USA

Cooperative Research Projects in the Microgravity Combustion Science Programs Sponsored by NASA and NEDO

Ross, Howard, Compiler, NASA Glenn Research Center, USA; January 2000; 210p; In English; Original contains color illustrations

Contract(s)/Grant(s): RTOP 963-15-0B

Report No.(s): NASA/TM-2000-209290; E-11762; NAS 1.15:209290; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

This document contains the results of a collection of selected cooperative research projects between principal investigators in the microgravity combustion science programs, sponsored by NASA and NEDO. Cooperation involved the use of drop towers in Japan and the USA, and the sharing of subsequent research data and findings. The topical areas include: (1) Interacting droplet arrays, (2) high pressure binary fuel sprays, (3) sooting droplet combustion, (4) flammability limits and dynamics of spherical, premixed gaseous flames and, (5) ignition and transition of flame spread across thin solid fuel samples. All of the investigators view this collaboration as a success. Novel flame behaviors were found and later published in archival journals. In some cases the experiments provided verification of the design and behavior in subsequent experiments performed on the Space Shuttle. In other cases, the experiments provided guidance to experiments that are expected to be performed on the International Space Station.

Author

Research; Microgravity; Combustion; Data Acquisition; Soot; Fuel Sprays; Flammability; Drops (Liquids)

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.

20000027698 National Inst. of Standards and Technology, Office of Weights and Measures Program, Gaithersburg, MD USA

Specifications, Tolerance and Other Technical Requirements for Weighing and Measuring Devices as Adopted by the 84th National Conference on Weights and Measures, 1999. 2000 Edition

Butcher, T. G., Editor, National Inst. of Standards and Technology, USA; Grimes, T. L., Editor, National Inst. of Standards and Technology, USA; Williams, J., Editor, National Inst. of Standards and Technology, USA; Nov. 1999; 312p; In English

Report No.(s): PB2000-101322; NIST/HB-44/2000; No Copyright; Avail: CASI; A03, Microfiche; A14, Hardcopy

Handbook 44 was first published in 1949, having been preceded by similar handbooks of various designations and in several forms, beginning in 1918. Handbook 44 is published in its entirety each year following the Annual Meeting of the National Conference on Weights and Measures. This 2000 edition was developed by the Committee on Specifications and Tolerances of the National Conference on Weights and Measures, with the assistance of the Office of Weights and Measures of the National Institute of Standards and Technology (NIST). The handbook includes amendments endorsed by the 84th National Conference on Weights and Measures during its Annual Meeting in 1999. The National Institute of Standards and Technology has a statutory responsibility for 'cooperation with the States in securing uniformity of weights and measures laws and methods of inspection.' NTIS

Measuring Instruments; Weight Measurement; Handbooks

20000028275 Condition Monitoring and Diagnostic Engineering Management International, Birmingham, UK

International Journal of COMADEM, Volume 1

Rao, Raj B. K. N., Editor, Condition Monitoring and Diagnostic Engineering Management International, UK; January 1998; ISSN 1363-7681; 40p; In English; See also 20000028276 through 20000028279; Copyright; Avail: Issuing Activity, Hardcopy

This is the initial issue of the journal. The interdisciplinary field of Condition Monitoring and Diagnostic Engineering Management (COMADEM) is established to provide an idea l platform for those who are engaged in managing change to come forward to share their valuable experiences with like minded professionals. The scope of the journal is such that it will be a significant vehicle for the exchange of topical information about what's actually happening within industry, government, academia and end user's environment.

CASI

Engineering Management; Research Management; Multidisciplinary Research; Operations Research; Management; Management Planning; Management Methods

20000028294 Maryland Univ., College Park, MD USA

MARV: Martian Airborne Research Vehicle

Blahut, Kevin, Maryland Univ., USA; Dickson, Ryan, Maryland Univ., USA; Karlgaard, Chris, Maryland Univ., USA; Coats, Brian, Maryland Univ., USA; Rodgers, Lakyetta, Maryland Univ., USA; Schoenfeld, Andrew, Maryland Univ., USA; Chang, Chol, Maryland Univ., USA; Kelly, George, Maryland Univ., USA; Kolb, John, Maryland Univ., USA; Boomer, Greg, Maryland Univ., USA; Second Annual HEDS-UP Forum; 1999, pp. 147-164; In English; See also 20000028286; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Current Mars reference missions specify Mission lengths that exceed present day limits on long-duration space flight. An increase in the length of on-site times over previous manned missions allows for greater scientific and exploratory flexibility. With this flexibility comes new opportunities for increasing our understanding of the solar system in which we live. to take advantage of these opportunities requires the development of new long-range transportation systems. Such systems must be able to operate in adverse environments with minimal investment in infrastructure while providing a high scientific return on investment. An aerial research vehicle provides a great deal of mobility in selecting specific sites to explore. Recent developments in the space community have recognized the need to explore beyond the limited scope offered by a stationary base camp or even a land rover. An airborne research vehicle provides the mobility to explore areas of interest that lie at great distances from the base site. Long distance missions requires the crew to have a great deal of discretion in selecting destinations based on information not available before the mission. Airships have the flexibility to travel to sites without prior knowledge of the site's conditions. The selection of an airship as the primary mode of transportation maximizes the crew's ability to act on "local decisions" which in turn increase the mission's scientific return.

Author

Mars (Planet); Mars Missions; Research Vehicles; Mars Surface

20000028295 Maryland Univ., College Park, MD USA

An Astronaut Assistant Rover for Martian Surface Exploration

Weisman, Steven, Editor, Maryland Univ., USA; Theobald, Debbie, Editor, Maryland Univ., USA; Roderick, Stephen, Editor, Maryland Univ., USA; Roberts, Brian, Editor, Maryland Univ., USA; Amato, Debbie, Maryland Univ., USA; Foster, Tony, Maryland Univ., USA; Henshaw, Glen, Maryland Univ., USA; Horlick, David, Maryland Univ., USA; Korona, Adam, Maryland Univ., USA; Larsen, Alan, Maryland Univ., USA; Second Annual HEDS-UP Forum; 1999, pp. 165-180; In English; See also 20000028286; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Lunar exploration, recent field tests, and even on-orbit operations suggest the need for a robotic assistant for an astronaut during extravehicular activity (EVA) tasks. The focus of this paper is the design of a 300-kg, 2 cubic meter, semi-autonomous

robotic rover to assist astronauts during Mars surface exploration. General uses of this rover include remote teleoperated control, local EVA astronaut control, and autonomous control. Rover size, speed, sample capacity, scientific payload and dexterous fidelity were based on known Martian environmental parameters, -stablished National Aeronautics and Space Administration (NASA) standards, the NASA Mars Exploration Reference Mission, and lessons learned from lunar and on-orbit sorties. An assumed protocol of a geological, two astronaut EVA performed during daylight hours with a maximum duration of four hours dictated the following design requirements: (1) autonomously follow the EVA team over astronaut traversable Martian terrain for four hours; (2) retrieve, catalog, and carry 12 kg of samples; (3) carry tools and minimal in-field scientific equipment; (4) provide contingency life support; (5) compile and store a detailed map of surrounding terrain and estimate current position with respect to base camp; (6) provide supplemental communications systems; and (7) carry and support the use of a 7 degree-of-freedom dexterous manipulator.
Author
Extravehicular Activity; Mars (Planet); Mars Exploration; Mars Surface; Robotics; Teleoperators

20000028297 Texas Univ., Austin, TX USA
Conceptual Design of a Mars Surface Transportation System (MSTS)
Collins, Chad, Texas Univ., USA; Gomez, Alex, Texas Univ., USA; Muniz, Rick, Texas Univ., USA; Musson, Dave, Texas Univ., USA; Second Annual HEDS-UP Forum; 1999, pp. 201-225; In English; See also 20000028286; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This report presents a proposed design for a Mars Surface Transportation system, abbreviated MSTS. This system is designed around the principle of maximum flexibility while maintaining minimal weight and minimal power requirements. It was the intent of the design team to explore new approaches to ground transportation rather than optimize previous approaches. The system presented in this report consists of an inflatable habitat/laboratory module, multiple electrically powered trucks, and a supporting space truss. The proposed series of configurations of these components is by no means meant to be comprehensive. The primary function of this system is to allow the development of new configurations as needed for mission requirements not yet identified. Furthermore, additional components and newly developed components of this system can be transported to Mars as they are needed or become available, as the case may be. Also contained within this report is a discussion of radiation and shielding considerations. Although a detailed discussion of this subject is beyond the scope of this report, the design team believes consideration of these issues is critical for a viable design proposal. Specifically, radiation exposure impacts on shielding requirements, and shielding requirements impact directly on mass, range, and duration away from a more adequately shielded home base. Finally, this report concludes with a discussion of subject areas in which the design team was unable to complete a thorough evaluation of because of time limitations. Suggestions are also made for further research by the scientific community to clarify issues that prevent a definitive design at this time. The authors of this proposal encourage feedback from interested parties that may lead to improvement of the design of this system.
Author
Mars Surface; Mission Planning; Roving Vehicles; Structural Design; Mars (Planet)

20000028299 Wichita State Univ., Wichita, KS USA
MARVIN: MARtian Vehicular INvestigator. A Proposal for a Long-Range Pressurized Rover
Khallock, Souhail, Wichita State Univ., USA; McKenna, Janna, Wichita State Univ., USA; Romine, Nathan, Wichita State Univ., USA; Ball, Danny, Wichita State Univ., USA; Owens, Skip, Wichita State Univ., USA; Rebours, Renaud, Wichita State Univ., USA; Hullinger, Brian, Wichita State Univ., USA; Laughton, Ryan, Wichita State Univ., USA; Nguyen, Maggie, Wichita State Univ., USA; Second Annual HEDS-UP Forum; 1999, pp. 247-264; In English; See also 20000028286; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

NASA is planning manned missions to Mars in the near future. In order to fully exploit the available time on the surface for exploration, a roving vehicle is necessary. A nine-member student design team from the Wichita State University Department of Aerospace Engineering developed the MARtian Vehicular INvestigator (MARVIN) a manned, pressurized, Iona distance rover. In order to meet the unique requirements for successful operation in the harsh Martian environment a four wheeled, rover was designed with a composite pressure vessel six meters long and 2.5 meters in diameter. The rover is powered by twin proton exchange membrane fuel cells which provide electricity to the drive motors and onboard systems The MARVIN concept is expected to have a 1500 km range with a maximum speed of 25 km/hr and a 14-day endurance.
Author
Mars (Planet); Mars Environment; Mars Missions; Roving Vehicles; Mars Exploration

20000028386 NASA Langley Research Center, Hampton, VA USA

Advancement of Bi-Level Integrated System Synthesis (BLISS)

Sobieszczanski-Sobieski, Jaroslaw, NASA Langley Research Center, USA; Emiley, Mark S., George Washington Univ., USA; Agte, Jeremy S., Department of the Air Force, USA; Sandusky, Robert R., Jr., George Washington Univ., USA; Jan. 01, 2000; 12p; 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 2000-0421; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Bi-Level Integrated System Synthesis (BLISS) is a method for optimization of an engineering system, e.g., an aerospace vehicle. BLISS consists of optimizations at the subsystem (module) and system levels to divide the overall large optimization task into sets of smaller ones that can be executed concurrently. In the initial version of BLISS that was introduced and documented in previous publications, analysis in the modules was kept at the early conceptual design level. This paper reports on the next step in the BLISS development in which the fidelity of the aerodynamic drag and structural stress and displacement analyses were upgraded while the method's satisfactory convergence rate was retained.

Author

Multidisciplinary Design Optimization; Systems Engineering; Design Analysis

20000029598 ERES Consultants, Inc., Champaign, IL USA

Determination of Frost Penetration in LTPP Sections ***Final Report, Aug. 1997 - Jul. 1998***

Ali, H. A.; Tayabji, S. D.; Sep. 1999; 142p; In English

Contract(s)/Grant(s): DTFH61-96-C-00003

Report No.(s): PB2000-102952; FHWA/RD-99/088; No Copyright; Avail: CASI; A02, Microfiche; A07, Hardcopy

To better understand the environmental factors and their effects on pavement performance, the Long Term Pavement Performance (LTPP) Seasonal Monitoring Program (SMP) was initiated during 1992. Sixty-four LTPP pavement sections were identified to be included in the SMP. These sections are monitored frequently to acquire data on seasonal variation in pavement conditions. As part of this program, work is being performed to identify and monitor the freeze state in the base, subbase, and subgrade at the SMP sections located in the freeze zone in the USA and Canada. This work makes use of temperature sensors and electrical techniques. The main goal of the study reported here was to determine frost penetration at the selected SMP sections. As part of the study, an interactive computer program, FROST, was developed to facilitate the interpretation of the electrical resistivity and temperature data. Analysis results included the freeze state at each electrical resistivity sensor and the frost penetration at each site. As part of the overall LTPP data analysis effort, it is expected that the information on the seasonal variation in the freeze state in the unbound base, subbase, and subgrade will be used to develop improved understanding of the seasonal variation in the load-carrying capacity of pavements and the subsequent effect on pavement performance.

NTIS

Pavements; Penetration; Frost

20000031678 Department of the Navy, Washington, DC USA

Torsionally Resonant Toroidal Thermoacoustic Refrigeration

Garrett, Steven L., Inventor; Sep. 21, 1999; 8p; In English; Supersedes US-Patent-Appl-SN-09005980

Patent Info.: Filed 13 Jan. 1998; US-Patent-5,953,921; US-Patent-Appl-SN-09,005,980

Report No.(s): AD-D019544; No Copyright; Avail: US Patent and Trademark Office, Microfiche

This invention for the production of high amplitude acoustic standing waves, which can be used for thermoacoustic heat transport purposes, describes the use of a rigid barrier in place of a piston, thereby allowing the suspension of the resonator to be external to the pressurized resonator and allowing an independent choice of motor mechanism. including the use of rotary motors instead of linear motors, while incidentally providing a mechanism for circulating external heat transport fluids without requiring additional pumps or heat pipes.

DTIC

Patents; Refrigerating; Sound Waves

20000031740 Department of the Navy, Washington, DC USA

Flow Release Elastomeric Ejection System

Curtis, Clifford M., Inventor; Apr. 02, 1999; 16p; In English

Patent Info.: Filed 2 Apr. 1999; US-Patent-Appl-SN-09,287,170

Report No.(s): AD-D019516; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

This invention relates to an apparatus for providing a rapid fluid impulse which can be used for launching vehicles into a liquid medium. The apparatus comprises a ring diaphragm of coupled concentric elastomeric rings, adapted to accept pressurized fluid at an interior side. The pressurized fluid extends the elastomeric rings of the ring diaphragm, placing them in shear strain. When the fluid is released, a kinetic impulse is provided and the ring diaphragm returns to its resting position. The apparatus further comprises a central check valve on the ring diaphragm. The check valve allows fluid to flow from an exterior side, through the ring diaphragm, to the interior side when exterior fluid pressure exceeds interior pressure. The invention is useful in a submarine vehicle launch assembly wherein the ring diaphragm is a component thereof.
DTIC
Patent Applications; Fluid Pressure; Shear Strain; Launching

20000031881 Department of the Navy, Washington, DC USA
Calibration of te Normal Pressure Transfer Function of a Compliant Fluid-Filled Cylinder
Peloquin, Mark S., Inventor; Sep. 07, 1999; 8p; In English; Supersedes US-Patent-Appl-SN-08865150, AD-D018617.
Patent Info.: Filed 29 May 97,; US-Patent-Appl-SN-08,865,150; US-Patent-5,948,959
Report No.(s): AD-D019561; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A method is presented to calibrate the transfer function for a fluid-filled compliant cylinder as a function of wave number and frequency. An air-filled compliant cylinder has a first linear array of force sensors coupled to the cylinder's exterior surface. A turbulent flow field is generated in a fluid environment about the first linear array which generates an output indicative of pressure incident thereupon. A fluid-filled compliant cylinder identical in diameter to the air-filled compliant cylinder houses a second linear array of force sensors. A similar turbulent flow field is generated in the fluid environment about the fluid-filled complaint cylinder to generate an output indicative of pressure incident upon the second linear array. The ratio of outputs is indicative of the transfer function of the fluid-filled compliant cylinder Each output can be further adjusted by a calibrated sensitivity of the corresponding first and second linear arrays. The method compensates for elastic scattered pressure fields and the wave number frequency dependence of the air-filled compliant cylinder's sensitivity to pressure.
DTIC
Calibrating; Transfer Functions; Elastic Properties; Cylindrical Bodies; Patents

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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.

20000027696 Working Group on Electronic Commerce, Washington, DC USA
US Government Working Group on Electronic Commerce: Towards Digital Equality ***Annual Report***
1999; 74p; In English
Report No.(s): PB2000-102836; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

This report outlines the progress made on many and notes the many policy changes that have occurred in the past year which will serve to further the goals of this Administration with respect to e-commerce. These developments include (1) a long term extension of the R&D (technically, the Research and Experimentation) tax credit to stimulate additional private sector research; (2) a dramatic increase in federal funding for the information technology sector (basic and applied IT research); (3) new intellectual property protection for patents and trademarks; and (4) substantial progress on international issues relating to taxation consumer protection, non-discrimination against e-commerce in international trade, and an emerging consensus on an extension of a moratorium on new tariffs for e-commerce.
NTIS
Commerce; Information Systems; Digital Systems

20000028378 Department of Defense, Office of the Inspector General, Arlington, VA USA
Congressionally Requested Audit of the Airborne Self-Protection Jammer
Reed, Donald E.; Rau, Russell A.; Meling, John E.; Flynn, Brian; Loeb, Frank X.; Feb. 22, 1999; 42p; In English
Report No.(s): AD-A372900; IG/DOD-95-128; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Airborne Self-Protection Jammer (ASPJ) is an electronic countermeasure system. Operational test and evaluation of the ASPJ system, using the Navy's F/A-18 aircraft, determined that the ASPJ was not operationally suitable or operationally effective,

resulting in termination of production contracts in December 1992. However, the Navy plans to use the ASPJ on 33 F-14D aircraft if operational tests show that the aircraft are more survivable with ASPJ than without it. The F-14D aircraft operational tests are scheduled for FY 1995. The Under Secretary of Defense for Acquisition and Technology supports ASPI deployment if it contributes to F-14D survivability. In addition, the DoD plans to assist the foreign sales of the ASPJ through ASPJ software integration on F/A-18 and F-16 aircraft. We initiated this audit at the request of Senator David Pryor. He asked us to evaluate Navy plans to test and install the ASPI on the F-14D aircraft, review the appropriateness of DoD integration of ASPJ software through Foreign Military Sales, and review DoD efforts to identify cost-effective self-protection systems for common use on Navy and Air Force aircraft.
DTIC
Jammers; Protection; Electronic Countermeasures; Radar Equipment

20000028379 Department of Defense, Office of the Inspector General, Arlington, VA USA
Communications Systems Year 2000 End-to-End Tests
Granetto, Paul J.; Stephenson, Garold E.; Shaw, Kent E.; Jennings, Elaine M.; Case, Steve I.; Dec. 23, 1999; 33p; In English
Report No.(s): AD-A373001; IG/DOD-D2000-066; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report is one in a series being issued by the Inspector General, DoD, in accordance with an informal partnership with the Chief Information Officer, DoD, to monitor DoD efforts to address the year 2000 computing challenge. This report addresses year 2000 issues that pertain to the end-to-end testing of communications systems. For a listing of audit projects addressing the issue, see the year 2000 webpage on the IGNET at http://www.ignet.gov. The overall objective of the audit was to evaluate the effectiveness of the planned communications systems Y2K end-to-end tests. Specifically, we reviewed mission-critical communications systems to determine whether they were tested as required and verified that test plans and results conformed to requirements in the DoD Y2K Management Plan.
DTIC
Telecommunication; Management Planning; Command and Control

20000030651 NASA Glenn Research Center, Cleveland, OH USA
Leo Satellite Communication through a LEO Constellation using TCP/IP Over ATM
Foore, Lawrence R., Analex Corp., USA; Konangi, Vijay K., Cleveland State Univ., USA; Wallett, Thomas M., NASA Glenn Research Center, USA; 1999; 6p; In English
Contract(s)/Grant(s): NCC3-595; RTOP 632-50-5A; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The simulated performance characteristics for communication between a terrestrial client and a Low Earth Orbit (LEO) satellite server are presented. The client and server nodes consist of a Transmission Control Protocol /Internet Protocol (TCP/IP) over ATM configuration. The ATM cells from the client or the server are transmitted to a gateway, packaged with some header information and transferred to a commercial LEO satellite constellation. These cells are then routed through the constellation to a gateway on the globe that allows the client/server communication to take place. Unspecified Bit Rate (UBR) is specified as the quality of service (QoS). Various data rates are considered.
Author
Satellite Communication; Satellite Constellations; Protocol (Computers)

20000030653 NASA Glenn Research Center, Cleveland, OH USA
Performance of Duplex Communication between a Leo Satellite and Terrestrial Location Using a Geo Constellation
Robinson, Daryl C., Cleveland State Univ., USA; Konangi, Vijay K., Cleveland State Univ., USA; Wallett, Thomas M., NASA Glenn Research Center, USA; [1998]; 8p; In English
Contract(s)/Grant(s): NCC3-595; RTOP 632-50-5A; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A network comprised of a terrestrial site, a constellation of three GEO satellites and a LEO satellite is modeled and simulated. Continuous communication between the terrestrial site and the LEO satellite is facilitated by the GEO satellites. The LEO satellite has the orbital characteristics of the International Space Station. Communication in the network is based on TCP/IP over ATM, with the ABR service category providing the QoS, at OC-3 data rate. The OSPF protocol is used for routing. We simulate FTP file transfers, with the terrestrial site serving as the client and the LEO satellite being the server. The performance characteristics are presented.
Author
Communication Satellites; Constellations; Duplexers; Networks; Terrestrial Planets

20000030696 Swedish Defence Research Establishment, Dept. of Command and Control Warfare Technology, Linkoeping, Sweden

Modeling Tactical Mobile Radio Networks Based on Interference Environment ***Interferensbaserad Modell av Taktiska Mobila Radioaet***

Groenkvist, J.; Sterner, U.; Englund, E.; Hansson, A.; Joensson, C.; Jun. 1999; ISSN 1104-9154; 32p; In English

Report No.(s): PB2000-103049; FOA-R-99-01155-504-SE; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The presentation reflects the current state of an ongoing research activity, entitled 'Mobile radio networks', at the Swedish Defense Research Establishment. The activity is a part of the project, 'Robust data networks' with aim of identifying, studying and proposing solutions that will satisfy the military demands on future data communications networks. One important component in the future data communication is a mobile radio network that is independent of a fixed infrastructure. The research in 'Mobile radio networks' is devoted to tactical multi-hop radio networks. In particular, the authors present methods and models for estimating and simulating the effects of mobility in real terrain on network protocols. The author's aim is to estimate and simulate network performance, and to evaluate network designs and protocols in a real terrain environment. The authors describe their method and models for simulating network performance in digitized terrain. The method is based on estimating the basic-path-loss. It utilizes a digitized terrain and advanced electro-magnetic propagation models to model the impact of terrain. The authors present the proposed methods as well as an overview of current work, including: spatial reuse access schemes, mobility model and analyses of the duration of an access protocol.

NTIS

Network Analysis; Communication Networks; Radio Frequency Interference; Mobile Communication Systems; Radio Communication

20000031357 Eastern Shore Reasearch Corp., Camden, NY USA

Multichannel Receiver Characterization for Adaptive Array Applications, Phase 5, Experiments/DSP Software ***Final Report, Sep. 1997 - Sep. 1999***

Simkins, William L.; Dec. 1999; 94p; In English

Contract(s)/Grant(s): F30602-95-C-0015; AF Proj. 4506

Report No.(s): AD-A373224; AFRL-SN-RS-TR-1999-250-Phase-5; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report presents the results of the fifth and final task of the effort. The task had two objectives. The first objective was to determine the capability and limitations of an S-band system to provide a useful foliage penetration (FOPEN) capability. This objective required measurements of foliage attenuation as a function of foliage depth and measurements of the effective radar cross section (RCS) of screened moving vehicles. The second objective was to develop a near real-time signal processing capability using a new VXI-based digital signal processing (DSP) module. This high speed processing would be used in performing statistically significant RCS and attenuation measurements as well as demonstrating the capabilities of a bistatic adjunct receiver in a real-time environment.

DTIC

Characterization; Multichannel Communication; Antenna Arrays; Adaptation; Radio Receivers; Software Engineering; Radar Receivers; Radar Antennas

20000031607 Aerojet-General Corp., Azusa, CA USA

Integrated Advanced Microwave Sounding Unit-A (AMSU-A). Engineering Test Report: Radiated Emissions and SARR, SARP, DCS Receivers, Link Frequencies EMI Sensitive Band Test Results, AMSU-A1, S/N 108 2 ***Final Report***

Valdez, A., Aerojet-General Corp., USA; Feb. 21, 2000; 92p; In English

Contract(s)/Grant(s): NAS5-32314

Report No.(s): AEROJET-11644; CDRL-207; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This is the Engineering Test Report, Radiated Emissions and SARR, SARP, DCS Receivers, Link Frequencies EMI Sensitive Band Test Results, AMSU-A1 SIN 108, for the Integrated Advanced Microwave Sounding Unit-A (AMSU-A).

Author

Advanced Microwave Sounding Unit; Microwave Sounding; Remote Sensors; Earth Observing System (EOS)

20000031608 Aerojet-General Corp., Azusa, CA USA

Integrated Advanced Microwave Sounding Unit-A (AMSU-A). Engineering Test Report: Radiated Emissions and SARR, SARP, DCS Receivers, Link Frequencies EMI Sensitive Band Test Results, AMSU-A1, S/N 109

Valdez, A., Aerojet-General Corp., USA; Mar. 08, 2000; 92p; In English

Contract(s)/Grant(s): NAS5-32314
Report No.(s): AEROJET-11665; CDR-207; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This is the Engineering Test Report, Radiated Emissions and SARR, SARP, DCS Receivers, Link Frequencies EMI Sensitive Band Test Results, AMSU-A1, S/N 109, for the Integrated Advanced Microwave Sounding Unit-A (AMSU-A).

Author

Advanced Microwave Sounding Unit; Microwave Sounding; Remote Sensors; Earth Observing System (EOS); Remote Sensing

20000031612 Research Inst. of National Defence, Dept. of Command and Control Warfare Technology, Linkoeping, Sweden

Five Essays on Routing for Tactical Wireless Mobile Networks ***Fem Uppsater om Routing i Taktiska Mobila Radionaet***

Englund, E.; Groenkvist, J.; Hansson, A.; Johansson, E.; Joensson, C.; Jun. 1999; ISSN 1104-9154; 58p; In Swedish
Report No.(s): PB2000-103060; FOA-R-99-01156-504-SE; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

The five essays presented represent the output of a course devoted to routing systems in tactical mobile radio networks at the Swedish Defense Research Establishment. The purpose of the report is to reflect the current state of research in the area and to point out open problems, essential for the fulfillment of the tactile demands on a mobile radio network. The authors' approach is to view a selection of potential routing methods and techniques with respect to the requirements put on a tactical mobile network. The routing system determines and controls traffic flow in the network. It is responsible for providing the appropriate level of service according to the current traffic load in the network. It must be able to handle mobility such that the communication between endpoints is not interrupted. In a tactical mobile network, the routing system must withstand rapid and unexpected changes in the network topology.

NTIS

Mobile Communication Systems; Communication Networks; Wireless Communication

20000031636 Naval Postgraduate School, Dept. of Electrical and Computer Engineering, Monterey, CA USA

Detection and Parameter Estimation of Chirped Radar Signals ***Final Report, Sep. 1998-Dec. 1999***

Hippenstiel, R.; Fargues, M. P.; Moraitakis, I.; Williams, C.; Jan. 10, 2000; 93p; In English
Contract(s)/Grant(s): MIPR-448-991831
Report No.(s): AD-A372866; NPS-EC-00-001; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This work investigated the detection of pulses and extraction of modulation parameters from different types of time-limited chirp signals, as may be found in pulse- compression radar signals. The work is split into two parts. The first part examines the pulse detection problem, i.e., the detection of the pulse start/stop times. Such information can be used to determine the pulse width and repetition rate of the radar systems under investigation in an automated fashion. We compare the robustness of three TCF-based schemes and an envelope detection algorithm in noisy environments.

DTIC

Detection; Robustness (Mathematics); Estimating

20000031638 Naval Postgraduate School, Monterey, CA USA

Global Broadcast Service Reach Back Via Satellite Tactical Digital Link J (S-TADIL J)

Fenton, Sandra J.; Sep. 1999; 78p; In English
Report No.(s): AD-A372953; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

To meet the increasing need for additional wideband satellite capability within the Department of Defense, the Global Broadcast Service (GBS) is being developed. GBS is an asymmetric network providing up to 24 Mbps from the Satellite Broadcast Manager (SBM) to deployed forces via UHF Follow On (UFO) satellites during GBS Phase Two. The concept of Smart Push provides for most of the users' needs but cannot anticipate every need or emerging needs of the user. The user through User Pull requires the ability to request information products from the SBM through existing communication paths. This capability is termed reach back. Due to the nature of operations, not as much information is sent back from operating forces to headquarters commands; therefore, less bandwidth is required from deployed forces to headquarters commands. Reach back channels do not require as much bandwidth as GBS. This research explores the viability of using Satellite Tactical Digital Link J (S-TADIL J), also known as Satellite Link 16, as a reach back option for GBS.

DTIC

Communication Satellites; Broadcasting; Bandwidth

20000031650 Draper (Charles Stark) Lab., Inc., Cambridge, MA USA

Integrated Communication Specification for the Reduced Ships-Crew by Virtual Presence (RSVP) Advanced Technology Demonstration (ATD) ***Interim Report, Nov. 1999-Jan. 2000***

Schwartz, Gary; Jan. 18, 2000; 92p; In English

Contract(s)/Grant(s): N00014-99-C-0033

Report No.(s): AD-A373239; 321302-REV; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This document describes data communication throughout the Reduced Crew by Virtual Presence (RSVP) system.

DTIC

Radiotelephones; Data Transmission

20000031680 Standard Object Systems, Inc., Standard Object Systems Inc., Opelousas, LA USA

Advanced Audio Interface for Phonetic Speech Recognition in a High Noise Environment

Jan. 2000; 6p; In English

Contract(s)/Grant(s): F41624-99-C-6019

Report No.(s): AD-A373461; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Standard Object Systems, Inc. (SOS) has used its existing technology in phonetic speech recognition, audio signal processing, and multilingual language translation to design and demonstrate an advanced audio interface for speech recognition in a high noise military environment. The Phase 1 result was a design for a Phase 2 prototype system with unique dual microphone hardware with adaptive digital filtering for noise cancellation which interfaces to speech recognition software. It uses auditory features in speech recognition training, and provides applications to multilingual spoken language translation. As a future Phase 3 commercial product, this system will perform real time multilingual speech recognition in noisy vehicles, offices and factories. The potential market for this technology includes any commercial speech and translation application in noisy environments.

DTIC

Speech Recognition; Noise Reduction; Voice Communication; Auditory Signals; Real Time Operation; Signal Processing

20000031704 Department of the Navy, Washington, DC USA

Method and Apparatus for Generating Modified Speech from Pitch-Synchronous Segmented Speech Waveforms

Kang, George S., Inventor; Fransen, Lawrence J., Inventor; Aug. 03, 1999; 25p; In English; Supersedes US-Patent-Appl-SN-08553161

Patent Info.: Filed 7 Nov. 1995; US-Patent-5,933,808; US-Patent-Appl-SN-08,553,161

Report No.(s): AD-D019538; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A system that synchronously segments a speech waveform using pitch period and a center of the pitch waveform. The pitch waveform center is determined by finding a local minimum of a centroid histogram waveform of the low-pass filtered speech waveform for one pitch period. The speech waveform can then be represented by one or more of such pitch waveforms or segments during speech compression, reconstruction or synthesis. The pitch waveform can be modified by frequency enhancement/filtering, waveform stretching/shrinking in speech synthesis or speech disguise The utterance rate can also be controlled to speed up or slow down the speech.

DTIC

Signal Processing; Waveforms; Patents; Histograms

20000031705 Department of the Navy, Washington, DC USA

Beamformer with Adaptive Processors

Bond, James W., Inventor; Schmidt, Henry J., Inventor; Aug. 03, 1999; 7p; In English; Supersedes US-Patent-Appl-SN-08537374

Patent Info.: Filed 2 Oct. 1995; US-Patent-5,933,446; US-Patent-Appl-SN-08,537,374

Report No.(s): AD-D019539; No Copyright; Avail: US Patent and Trademark Office, Microfiche

The Beamformer with Adaptive Processors is a practical joint spatial-temporal processor suitable for combining multiple antenna signals for a communications receiver. The invention identifies a beam or beams, amongst a discreet set of fixed beams, for which adaptive locally optimum processing will most likely reveal the presence of a weak signal. The invention chooses a suitable form of adaptive locally optimum processing according to the nature of the beam or beams identified. The beam or beams are selected for adaptive locally optimum processing depending on several simple characteristics of a Fast Fourier Transform (FFT) of each beam's output. These are sum of a2, D, and B (the sum of the squares of the Fourier coefficients, the number of distinct peaks amongst these coefficients, and the total number of coefficients defining the peaks, respectively). A simple logic table is used to define the beam or beams to be used for adaptive processing and to define the nature of the adaptive processing to be used on the beams identified to most likely reveal the presence of a weak signal. The result of the combination of selecting

the most promising beam or beams and appropriately adaptively processing the beam or beams is a near optimal implementation of a joint temporal-spatial processor.
DTIC
Signal Processing; Patents; Beamforming

20000031726 Department of the Navy, Washington, DC USA
Coherent Hidden Markov Model
Stein, David, Inventor; May 04, 1999; 7p; In English; Supersedes US-Patent-Appl-SN-09112906
Patent Info.: Filed 9 Jul. 1998; US-Patent-5,900,835; US-Patent-Appl-SN-09,112,906
Report No.(s): AD-D019566; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A hidden Markov detector of the present invention comprises a hidden Markov parameter estimator for coupling to an input data source, a parameter smoother coupled to the parameter estimator, and a detection statistic calculator coupled to the parameter smoother and the input data source.
DTIC
Inventions; Signal Processing; Markov Processes; Patents

20000031727 Department of the Navy, Washington, DC USA
Frequency Domain Kernel Processor
Bond, James W., Inventor; Hui, Stefen, Inventor; Stein, David, Inventor; Zeidler, James, Inventor; May 11, 1999; 10p; In English; Supersedes US-Patent-Appl-SN-08909748
Patent Info.: Filed 12 Aug. 1997; US-Patent-5,903,483; US-Patent-Appl-SN-08,909,748
Report No.(s): AD-D019567; No Copyright; Avail: US Patent and Trademark Office, Microfiche

The frequency domain kernel processor of the present invention comprises a scheduler for selecting samples from blocks of Fourier transform coefficients in a predetermined sequence and for outputting the selected samples as serial terms s and as parallel terms u. A transform processor is coupled to the scheduler to receive the terms s and u. The transform processor comprises transform calculators for calculating output values p and f as functions of terms s and u to model the interference and to reveal the desired signal, a first sum calculator for calculating a sum of p values, a second summing calculator for calculating a sum off values, and a divider for calculating, the quotient of the sum of p values divider by the sum of f values. An output buffer stores the outputs of the divider for formatting as a spectral display.
DTIC
Fourier Transformation; Signal Processing; Patents

20000031777 Research Inst. of National Defence, Div. of Sensor Technology, Linkoeping, Sweden
Performance Tests of the RADAN 303B with Sub-ns Slicer and TEM-Antenna
Madsen, K.; May 1999; ISSN 1104-9154; 52p; In English
Report No.(s): PB2000-103088; FOA-R-99-01140-612-SE; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

The present report contains preliminary results of the performance and handling of a subnanosecond slicer with a broadband TEM-horn. The slicer was recently purchased by FMV Testing Directorate and is presently used by FOA Defense Research Establishment for HPM-research. The slicer is a pulse forming network connected as a load to the RADAN 303B pulsed power source, previously delivered to FOA. Measurements of pulse shape and voltages at the capacitive voltage divider are reported and also the received pulse forms from different types of receiving field sensors. The most promising type of sensor seems to be the D-dot probe, used with a Balun transformer. It has been found that the measurement results should be interpreted with some caution, since, e.g., reflections from the room having only partially absorbing walls have been found to interfere with the straight line of sight transmitted signal. An outdoor demonstration at the FMV Testing Directorate EMP test site was performed irradiating a personal computer.
NTIS
Antenna Radiation Patterns; Horn Antennas

20000031869 Department of the Navy, Washington, DC USA
Ultra High Bit Rate All Optical Communication System
Duling, Irl N., III, Inventor; Esman, Ronald D., Inventor; Sep. 28, 1999; 15p; In English; Supersedes US-Patent-Appl-SN-08186074
Patent Info.: Filed 25 Jan. 1994; US-Patent-5,959,753; US-Patent-Appl-SN-08,186,074
Report No.(s): AD-D019564; No Copyright; Avail: US Patent and Trademark Office, Microfiche

This invention discloses a system that uses all optical elements for transmission, regeneration and reception of solitons in point-to-point, broadcast, ring and multi-user trunk type communication systems. Soliton pulses from an optical clock source are modulated by optical data pulses in an optical modulator producing a modulated channel of data pulses. Several channels are combined by an optical multiplexer into a network optical bit stream. This stream is carried by an optical fiber and one or more of optical regenerators which recover the system clock and regenerate the signal with the recovered system clock rather than just amplifying the signal. Each of the regenerators can, in addition to regenerating the data, act as part of a data drop or insert node in a ring network Where the node can synchronously remove data from or insert data into the stream. Intermediate nodes can include packet drop/replace nodes if the network i.e., a packet type network. The destination can include an optical demultiplexer which demultiplexer the network stream into the individual channels, an optical clock recovery system that recovers the clock of the system and a receiver that receives the pulses of one of the demultiplexed channels. The system can also include optical logic for decoding and routing optical packets.
DTIC
Optical Communication; Optical Fibers; Telecommunication; Fiber Optics; Patents

20000031876 California Inst. of Tech., Div. of Physics, Mathematics, and Astronomy, Pasadena, CA USA
Submillimeter Atmospheric Transmission Measurements on Mauna Kea during Extremely Dry El Nino Conditions: Implications for Broadband Opacity Contributions, *2000-2003*
Pardon, J. R., California Inst. of Tech., USA; Serabyn, E., California Inst. of Tech., USA; Cernicharo, J., Consejo Superior de Investigaciones Cientificas, Spain; [2000]; 22p; In English
Contract(s)/Grant(s): NSF ATM-96-16766; NSF AST-96-15025; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
We present broadband atmospheric transmission spectra obtained on Mauna Kea, Hawaii (4100 m. above sea level) on UT April 1st 1998 and July 1st 1999 under very similar pressure and temperature conditions. The 1998 measurements occurred under conditions of extremely low atmospheric water vapor, with a ground-level relative humidity of approx. = 2%. As a result of its dryness the Mauna Kea site allows access to a partially transparent atmosphere up to frequencies exceeding 1000 GHz, where the relative importance of atmospheric continuum-like absorption is much larger than at millimeter wavelengths, and hence easier to measure. As shown in this paper, these conditions have allowed us to measure and separate the submillimeter absorption spectrum into three terms: resonant lines, non-resonant absorption of the dry atmosphere due to collision-induced mechanisms involving electric multipoles, and continuum-like water vapor opacity. The spectra presented here were obtained with a Fourier Transform Spectrometer (FTS) at the Caltech Submillimeter Observatory and cover a continuous frequency range from 350 GHz to 1100 GHz, with a finest spectral resolution of 200 MHz. The 1998 conditions were so exceptionally dry that an atmospheric window centered at 1035 GHz showed up to 35% zenith transmission. The calibration of our data is especially careful and includes corrections for differences between the ground atmospheric temperature and the calibrator temperature, as well as for the tropospheric temperature lapse rate, and the water vapor scale height. This procedure is able to yield transmission spectra calibrated to within 1-2%. A multilayer atmospheric radiative transfer model has been used for data analysis.
Author
Atmospheric Models; Atmospheric Moisture; Atmospheric Temperature; Broadband; Moisture Content; Radiative Transfer; Spectral Resolution

20000031937 Communications Research Lab., Tokyo, Japan
Recent Antenna Technologies
Tasuku, Teshirogi, Communications Research Lab., Japan; Review of the Communications Research Laboratory; Dec. 1993; ISSN 0914-9279; Volume 39, No. 4, pp. 287-297; In Japanese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
This paper reviews recent antenna technologies for various kinds of radio applications. Primarily it concentrates on microstrip or other planar antennas, but it also covers a large reflector satellite antenna and near-field antenna measurements. First, a concept of classification of antennas in terms of electrical dimensions is introduced. The author proposes a half-wave dipole with a ground plane as a standard antenna for classification. Several microstrip antennas and arrays developed by CRL, i.e. an airborne phased array for ETS-V mobile satellite communication experiments, a multibeam phased array for SIC (S-band Intersatellite Communication) of ETS-VI, a rectenna array for MILAX (Microwave Lifted Airplane Experiment), and a novel GPS receiver antenna with very wide hemispherical beam etc. are introduced. Furthermore, a large reflector multibeam antenna for 22GHz satellite broad-casting experiment and near-field antenna testing by planar and cylindrical scanning are also described.
Author
Antenna Arrays; Microstrip Antennas; Multibeam Antennas

20000031944 Research and Technology Organization, Information Systems Technology Panel, Neuilly-sur-Seine, France
Databases for Assessment of Military Speech Technology Equipment ***les Bases de donnees pour l'evaluation des equipements de technologie vocale militaire***
South, Allan, Defence Evaluation Research Agency, UK; March 2000; 30p; In English; CD ROM: CD ROM contains the entire technical report
Report No.(s): RTO-TR-25; AC/323(IST)TP/6; ISBN 92-837-1028-2; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche; C01, CD-ROM

A NATO research group carried out collaborative studies on military applications of speech processing. A major requirement in this area of work is for large quantities of speech recordings made in military environments, which are often expensive and difficult to obtain. Research and development in this area will benefit from sharing such data as widely as possible among the NATO research community. The cost of collecting speech recordings under realistic military conditions is high. Considerable cost savings may be made if such data are shared as widely as possible amongst the NATO community. The NATO research group on speech processing will continue to maintain and update the database of speech recordings relevant to military applications of speech technology. Further ways of disseminating this information will be sought, including electronic means such as the Internet. Author

Military Technology; Data Bases; Speech; Voice Data Processing; Data Acquisition; Voice Communication

20000031945 Research and Technology Organization, Information Systems Technology Panel, Neuilly-sur-Seine, France
The Impact of Speech Under "Stress" on Military Speech Technology ***l'Impact de la parole en condition de "stress" sur les technologies vocales militaires***
Vloeberghs, Claude, Research and Technology Organization, France; Verlinde, Patrick, Research and Technology Organization, France; Swail, Carl, Research and Technology Organization, France; Steeneken, Herman, Research and Technology Organization, France; vanLeeuwen, David, Research and Technology Organization, France; Trancoso, Isabel, Research and Technology Organization, France; South, Allan, Research and Technology Organization, France; Moore, Roger, Research and Technology Organization, France; Cupples, E. James, Research and Technology Organization, France; Anderson, Timothy, Research and Technology Organization, France; Jansen, John, Research and Technology Organization, France; March 2000; 115p; In English; CD ROM: CD Rom contains the entire technical document
Report No.(s): RTO-TR-10; AC/323(IST)TP/5; ISBN 92-837-1027-4; Copyright Waived; Avail: CASI; A06, Hardcopy; A02, Microfiche; C01, CD-ROM

Military operations are often conducted under conditions of stress induced by high workload, sleep deprivation, fear and emotion, confusion due to conflicting information, psychological tension, pain, and other typical conditions encountered in the modern battlefield context. These conditions are known to affect the physical and cognitive abilities of human speech characteristics, and this study was intended to determine the actual effects of stress on voice production quality. It is suggested that the effect of operator based stress factors on voice is likely to be detrimental to the effectiveness of communication in general, in particular to the performance of communication equipment and weapon systems equipped with vocal interfaces (e.g., advanced cockpits, command, control, and communication systems, information warfare). Progress in the field of military based speech technology, including advances in speech based system design has been restricted due to the lack of availability of databases of speech under stress. In particular, the type of stress which an operator may experience in the modern battlefield context is not easily simulated, and therefore it is difficult to systematically collect speech data for use in research and speech system training. It is foreseen that in the future it will be necessary to improve the coordination of multi-national military forces. The need therefore exists for planned simulations with military personnel using a wide range of speech technology and addressing factors such as high workload, sleep deprivation, fear and emotion, confusion, psychological tension, pain, etc.
Author

Military Operations; Military Technology; Speech Recognition; Voice Communication; Stress (Physiology); Human Factors Engineering; Stress (Psychology)

20000031950 Massachusetts Inst. of Tech., Lincoln Lab., Lexington, MA USA
EHF Satellite Communications on the Move: Baseband Considerations
Schodorf, Jeffrey B.; Feb. 14, 2000; 61p; In English
Contract(s)/Grant(s): F19628-95-C-0002
Report No.(s): AD-A373681; TR-1055; ESC-TR-99-048; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

In this report, baseband signal processing and networking protocol issues associated with the development of an EHF land mobile satellite communications system are investigated. Ignoring the very important problems of antenna pointing and tracking, the primary obstacle to be overcome by the system is signal blockage. At EHF, objects in the propagation path are virtually opaque

and cast a dark ”shadow” over the communications terminal, resulting in signal attenuations on the order of 20-30dB or more. The duration of these shadow regions or blockage intervals will depend on a number of factors, including object size and vehicle speed. Recommended solutions to this problem include the following: forward error correction coding at the physical layer to mitigate the effects of relatively short blockage intervals (i.e., milliseconds to seconds), and automatic repeat request schemes at the linklayer to ensure reliability over longer shadow regions (i.e., seconds to lOs of seconds) In addition, dynamic routing protocols can be used at the network layer to provide connectivity to blocked terminals via alternate terrestrial communications paths that include at least one unobstructed terminal. Finally, TCP splitting and protocol conversion offer a great deal of promise for achieving reliable end-to-end transport layer services without sacrificing TCP compatibility.
DTIC
Satellite Communication; Mobile Communication Systems; Extremely High Frequencies; Signal Processing

20000032022 Communications Research Lab., Tokyo, Japan
PRESTAR, 2, Microstrip Array Antenna for PRESTAR
Kurihara, Noriyuki, Communications Research Lab., Japan; Kaneko, Akihiro, Communications Research Lab., Japan; Tanaka, Masato, Communications Research Lab., Japan; Review of the Communications Research Laboratory; Dec. 1993; ISSN 0914-9279; Volume 39, No. 4, pp. 209-213; In Japanese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Communications Research Laboratory (CRL) has developed a precise positioning system called ”PRESTAR” which utilizes global positioning system (GPS). With this system an accuracy of 10(exp -7) can be achieved by receiving radio signals from the satellite at two frequency bands (L1 : 1.5 GHz, L2 : 1.2 GHz). We developed a light and cheap beam antenna for this receiving system. The antenna was designed as a microstrip array antenna, a sequential array composed of eight elements for L1 band and six elements for L2 band. Its gain with respect to a reference horn antenna was measured to be 18,7 dB for L1 and 13.1 dB for L2, which suffices the requirements of the receiving system ”PRESTAR”. This antenna is light enough to be mounted on the top of a standard tripod for ground surveying. This enables an easy mobile operation of this system in a field.
Author
Positioning; Microstrip Antennas; Antenna Arrays

20000032027 Scripps Institution of Oceanography, Office of Contract and Grant Administration, La Jolla, CA USA
Nearshore Airborne Lidar Observations *Progress Report, Sep. - Dec. 1999*
Sheremet, Alexandru; Feb. 17, 2000; 5p; In English
Contract(s)/Grant(s): N00173-99-1-G905
Report No.(s): AD-A373699; No Copyright; Avail: CASI; A01, Microfiche; A01, Hardcopy

Hwang et al. (1999a and 1999b) uses standard FFT procedures to estimate deep water 2-dimensional wavenumber spectra from lidar images. The characteristic wavelength analyzed is O(100m), homogeneity scale is O(10km) and wave evolution scale is O(100km). Knowledge of the local bathymetry allows, via the linear dispersion relation, is needed for retrieving frequency-directional spectrum. The classical Fourier transform approach (FT) fails in the nearshore region due to the strong spatial inhomogeneities of the wavefield, generated by lower order wave-bathymetry and quadratic wave-wave interaction. Shoaling waves evolve much faster than deep-water waves, over O(1km) scales (Elgar and Guza, 1985).
DTIC
Nearshore Water; Airborne Equipment; Optical Radar

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.

20000028355 National Inst. of Standards and Technology, Optoelectronics Div., Gaithersburg, MD USA
Electronics and Electrical Engineering Laboratory, Optoelectronics Division Programs, Activities and Accomplishments
Jan. 2000; 44p; In English
Report No.(s): PB2000-101783; NISTIR-5090; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Optoelectronics is the merger of optics and electronics in which devices such as lasers, detectors, and optical fibers have enabled many familiar and diverse high technology products and processes: high quality telephone systems, the Internet, laser printers, fax machines, compact disc technology for consumer electronics and computer storage, retail checkout systems,

advanced medical procedures, and new methods of manufacturing. Optoelectronics is a cornerstone of the Information Age and a large international business with intense competition. The worldwide market for optoelectronic components is currently around $50B, roughly one third of the size of the market for electronic components, and growing rapidly. The market for equipment enabled by optoelectronic components approaches $200B. Our job in the NIST Optoelectronics Division is to provide the optoelectronics industry with the measurement technology, standards, and traceability that it needs to grow and be competitive. Through a series of studies, the Optoelectronics Industry Development Association (OIDA) has concluded that metrology is one of the four key elements of manufacturing infrastructure in which investment needs to be made if the U.S. optoelectronics industry is to maintain or expand its competitive position in optoelectronics.
NTIS
Electrical Engineering; Research and Development; Electro-Optics

20000028367 EMC Compliance, Huntsville, AL USA
Investigation into the Effects of Microsecond Power Line Transients on Line-Connected Capacitors ***Final Report***
Javor, K., EMC Compliance, USA; February 2000; 38p; In English
Contract(s)/Grant(s): NASA Order H-29919-D
Report No.(s): NASA/CR-2000-209906; M-961; NAS 1.26:209906; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An investigation was conducted into the effect of power-line transients on capacitors used by NASA and installed on platform primary power inputs to avionics. The purpose was to investigate whether capacitor voltage ratings needs to be derated for expected spike potentials. Concerns had been voiced in the past by NASA suppliers that MIL-STD-461 CS06-like requirements were overly harsh and led to physically large capacitors. The author had previously predicted that electrical-switching spike requirements representative of actual power-line transient potentials, durations. and source impedance would require no derating. This investigation bore out that prediction. It was further determined that traditional low source impedance CS06-like transients also will not damage a capacitor, although the spikes themselves are not nearly as well filtered. This report should be used to allay fears that CS06-like requirements drive capacitor voltage derating. Only that derating required by the relatively long duration transients in power quality specification need concern the equipment designer.
Author
Power Lines; Capacitors

20000028383 Department of the Navy, Washington, DC USA
Standing Wave Plasma Antenna With Plasma Reflector
Anderson, Theodore R., Inventor; May 21, 1999; 19p; In English
Patent Info.: Filed 21 May 1999; US-Patent-Appl-SN-09/317084
Report No.(s): AD-D019511; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

A standing wave plasma antenna is provided. An ionizer generates an ionizing beam in a bounded plasma column extending along a vertical axis. A modulating signal is applied to an electro-optical crystal that modulates the ionizing beam. The resulting changes in the ionizing beam produce gradients in the plasma that cause ions and electrons to oscillate in a vertical path that generates alternating current having the frequency of the modulator. At a remote end the antenna terminates in a reflector. The reflector includes a chamber having a plasma with a charged particle density that is greater than the charged particle density in the plasma. The generated currents are therefore reflected as in a standing wave antenna. These currents generate an amplitude-, phase- or frequency-modulated electromagnetic field that radiates from the plasma column.
DTIC
Standing Waves; Plasma Antennas; Plasma Waves; Reflectors; Antenna Radiation Patterns

20000028384 Department of the Navy, Washington, DC USA
Plasma Antenna With Currents Generated by Opposed Photon Beams
Anderson, Theodore R., Inventor; Mar. 23, 1999; 26p; In English
Patent Info.: Filed 23 Mar. 1999; US-Patent-Appl-SN-09/285175
Report No.(s): AD-D019512; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

A plasma antenna with a plasma column is provided. Lasers are disposed to transmit photon beams through the plasma in an alternating, oppositely directed fashion. When a laser is energized, its laser beam produces photon-electron collisions that

impart momentum to electrons in the plasma. Alternating the operation of the lasers produces an alternating current in the plasma that radiates an electromagnetic field.
DTIC
Plasma Antennas; Alternating Current; Photon Beams

20000028385 Department of the Navy, Washington, DC USA
Magnesium Solution Phase Catholyte Seawater Electrochemical System
Medeiros, Maria G., Inventor; Tucker, Steven P., Inventor; Chichon, James M., Inventor; Bessette, Russell R., Inventor; Dischert, Dwayne W., Inventor; Mar. 02, 1999; 16p; In English
Patent Info.: Filed 2 Mar. 1999; US-Patent-Appl-SN-267905
Report No.(s): AD-D019513; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

In accordance with the present invention, an electrochemical system is provided which comprises a plurality of cells, the cells being formed by spaced apart bipolar electrodes. Each of the electrodes is formed by an anode portion formed from a magnesium containing material and an electrocatalytic material joined to a surface of the anode. The electrodes are spaced such that the anode portion of one electrode faces the electrocatalytic material of the adjacent electrode. The electrochemical system also comprises a manifold system for introducing a seawater-catholyte solution into the spaces between the electrodes. An electrical connection is provided across the cells so as to initiate the reduction of the seawater-catholyte solution at the electrodes and to create electrical power. In a preferred embodiment, the seawater-catholyte solution is a seawater-hydrogen peroxide or seawater-sodium hypochlorite solution. A process for generating electrical power using the electrochemical system of the present invention is also described.
DTIC
Magnesium; Catholytes; Sea Water; Electrochemistry; Solutions

20000028412 National Inst. of Standards and Technology, Semiconductor Electronics Div., Gaithersburg, MD USA
Electronics and Electrical Engineering Laboratory, Semiconductor Electronics Division Programs, Activities, and Accomplishments
Jan. 2000; 58p; In English
Report No.(s): PB2000-102890; NISTIR-6430; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

The Semiconductor Electronics Division provides leadership in developing the semiconductor measurement infrastructure essential to improving US economic competitiveness by providing necessary measurements, physical standards, and supporting data and technology; associated generic technology; and fundamental research results to industry, government, and academia. The primary focus is on mainstream silicon. The Division's programs also respond to industry measurement needs related to compound semiconductors, power devices, and silicon-on-insulator devices.
NTIS
Electrical Engineering; Semiconductors (Materials)

20000029565 Tohoku Univ., Research Inst. of Electrical Communication, Sendai, Japan
A Study on Sensorless Driving Systems of Brushless DC Motors Using Neural Network
Suzuki, Keita, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; August 1999; ISSN 0385-7719; Volume 68, No. 1, pp. 235-236; In Japanese; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In this paper, a new sensorless driving system of brushless DC Motor using neural network has been proposed. In the system, considering the nonlinear characteristics and the parameter error of the motor, two neural networks have been introduced to estimate electromotive force (EMF) and motions of a real motor, respectively, using the current errors between a real motor and a motor neural model. Using the EMF signal, a difference position information will be used to update the current position so that a sensorless driving system will keep working.
Author
Neural Nets; Electromotive Forces; Electric Motors

20000030659 NASA Kennedy Space Center, Cocoa Beach, FL USA

Non-Intrusive Impedance-Based Cable Tester

Medelius, Pedro J., Inventor, NASA Kennedy Space Center, USA; Simpson, Howard J., Inventor, NASA Kennedy Space Center, USA; Nov. 02, 1999; 8p; In English

Patent Info.: Filed 15 Aug. 1997; NASA-Case-KSC-11866; US-Patent-5,977,773; US-Patent-Appl-SN-912035; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A non-intrusive electrical cable tester determines the nature and location of a discontinuity in a cable through application of an oscillating signal to one end of the cable. The frequency of the oscillating signal is varied in increments until a minimum, close to zero voltage is measured at a signal injection point which is indicative of a minimum impedance at that point. The frequency of the test signal at which the minimum impedance occurs is then employed to determine the distance to the discontinuity by employing a formula which relates this distance to the signal frequency and the velocity factor of the cable. A numerically controlled oscillator is provided to generate the oscillating signal, and a microcontroller automatically controls operation of the cable tester to make the desired measurements and display the results. The device is contained in a portable housing which may be hand held to facilitate convenient use of the device in difficult to access locations.

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

Electric Potential; Impedance; Nonintrusive Measurement; Oscillators; Automatic Test Equipment

20000030664 Vectron International, Norwalk, CT USA

Low G-Sensitive Quartz Resonators, and Low-Power Clock Utilizing the Resonators ***Final Report, Oct. 1997 - Sep. 1999***

Stewart, James, Vectron International, USA; Dec. 1999; 119p; In English

Contract(s)/Grant(s): N66001-97-C-8635

Report No.(s): AD-A373436; CECOM-TR-97-8635-F; No Copyright; Avail: CASI; A02, Microfiche; A06, Hardcopy

This report presents the results of ongoing theoretical and experimental work toward reducing the sensitivity of crystal resonators to vibration and other accelerations. Strip resonators were the chosen embodiment, and extensive finite element analysis was performed on various electrode configurations and cantilever extensions of the crystal blank beyond the supports. Measurements on resonators fabricated following theoretical designs have shown that acceleration sensitivity has been reduced by an order of magnitude, to one tenth part per billion per g. There are indications that the techniques reported here can yield another order of magnitude improvement. Theory, finite element analysis, design approach, construction details, and test results are presented.

DTIC

Crystal Oscillators; Cantilever Beams; Fabrication; Finite Element Method; Quartz; Resonators

20000030668 Department of the Navy, Washington, DC USA

Pentacene Derivatives as Red Emitters in Organic Light Emitting Devices

Crisafulli, Lisa A., Inventor; Murata, Hideyuki, Inventor; Kafafi, Zakya H., Inventor; Dec. 16, 1999; 16p; In English

Patent Info.: Filed 16 Dec. 1999; US-Patent-Appl-SN-09/464,090

Report No.(s): AD-D019606; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

Pentacene derivatives substituted with two or more aromatic, substituted aromatic, heteroaromatic, or substituted heteroaromatic groups are dopants for organic electroluminescent devices. When combined with host materials and incorporated into an organic light emitting devices, the pentacene derivatives are red emitters with narrow spectra.

DTIC

Light Emitting Diodes; Electroluminescence

20000030689 Department of the Navy, Washington, DC USA

Dual Adjusting Override Precision Switch Activator

Vendetti, Vincent J., Inventor; Canaday, Michael M., Inventor; Jan. 10, 2000; 13p; In English

Patent Info.: Filed 10 Jan. 00.

Report No.(s): AD-D019607; PAL-APPL-09-480,422; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A switching assembly that operatively cooperates with the triggering mechanism of a firearm, such as a rocket launcher, is disclosed. The switching assembly allows for an adjustable trigger linear travel of about 0.4” within an accuracy of 0.01 inches, while at the same time prevents any over-travel of the switch activator from damaging a depressible switch that is operatively interconnected to firing of the rocket from the launcher.

DTIC

Rocket Launchers; Patent Applications; Inventions; Trigger Circuits

20000030713 Department of the Navy, Washington, DC USA

BAF2/GAAS Electronic Components

Santiago, Francisco, Inventor; Chu, Tak K., Inventor; Aug. 03, 1999; 8p; In English

Patent Info.: Filed 25 Mar. 96,; US-Patent-Appl-SN-08-624-847; US-Patent-5,932,006

Report No.(s): AD-D019595; No Copyright; Avail: US Patent and Trademark Office, Microfiche

Metal insulator semiconductor field effect transistors (MISFETs), charge coupled devices (CCDs), and capacitors based on an epitaxial barium fluoride (BF) insulator layer deposited directly onto a single crystal gallium arsenide (GaAs) substrate.

DTIC

Field Effect Transistors; MIS (Semiconductors); Charge Coupled Devices

20000030718 Department of the Navy, Washington, DC USA

Fringe Field Superconducting System

Johnson, Mark B., Inventor; Clinton, Thomas W., Inventor; Jul. 27, 1999; 21p; In English; Supersedes US-Patent-Appl-SN-08-962, AD-D018666.

Patent Info.: Filed 31 Oct. 97,; US-Patent-Appl-SN-08-962-454; US-Patent-5,930,165

Report No.(s): AD-D019602; No Copyright; Avail: US Patent and Trademark Office, Microfiche

The instant invention is a switch, comprising: (1) a pathway of a super conductive material; and (2) a ferromagnet, where the ferromagnet is adapted for having at least a first magnetization state and a second magnetization state, where fringe fields from the ferromagnet in the first magnetization state do not exceed a predetermined magnetic field in the super conductive pathway to convert at least a portion of the super conductive pathway to the normal state; where fringe fields from the ferromagnet in the second magnetization state exceed the predetermined magnetic field in the super conductive pathway to convert at least a portion of the super conductive pathway to the normal state.

DTIC

Superconductivity; Switches; Inventions; Patent Applications

20000030732 Eaton Corp., Sarasota, FL USA

High Current 270 Vdc Contractor and Current Sensor System Design and Development ***Final Report, Oct. 1994 - Aug. 1998***

Sande, Sean, Eaton Corp., USA; Kitts, Karl, Eaton Corp., USA; Shanebrook, Robert, Eaton Corp., USA; Timm, Dennis, Eaton Corp., USA; Tran, Tuan N., Eaton Corp., USA; Sep. 1998; 145p; In English

Contract(s)/Grant(s): F33615-93-C-2359; AF Proj. 3145

Report No.(s): AD-A373465; AFRL-PR-WP-TR-1998-2131; No Copyright; Avail: CASI; A02, Microfiche; A07, Hardcopy

The work reported in this document is the High Current 270 Volt direct current (Vdc) Contactor and Current Sensor System Design and Development Program. This report covered the entire program from the conceptual design through Preliminary design Review (PDR) phase, Critical Design Review (CDR) phase, and the Acceptance Testing (ATP).

DTIC

Electronic Equipment; Design Analysis; Systems Engineering; Direct Current; High Voltages

20000031345 Kent State Univ., OH USA

Liquid Crystal Cells for Blazed Grating Steering Devices ***Final Report, 15 Sep. 1996-14 Oct. 1999***

Lavrentovich, O. D.; Bos, P. J.; Shiyanovskii, S. V.; Titus, Ch; Subacius, D.; Dec. 08, 1999; 104p; In English

Contract(s)/Grant(s): F49620-96-C-0449

Report No.(s): AD-A373578; AFRL-SR-BL-TR-00-0034; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Two types of non-mechanical liquid crystal laser beam steering devices were developed. The first is a prismatic refractive device with a smectic liquid crystal wedge as a passive light deflector and twisted nematic flat cell as an optical switch. The prismatic device has constant deflected beam intensity for all deflection angles (several degrees) and works in the (1-10) ms range of the response times. The other type is based on electrically controlled cholesteric diffraction gratings. The cholesteric grating is a phase grating capable of both Bragg and Raman-Nath diffraction and two modes of operation: simple electric switching between non-diffractive and diffractive regimes; continuous beam steering up to 20 degrees. This devices works in the (10-100) ms range of the response times.

DTIC

Liquid Crystals; Beam Steering; Display Devices; Laser Beams

20000031358 Florida Univ., Dept. of Electrical and Computer Engineering, Gainesville, FL USA

Development of High Performance Multicolor Quantum Well Infrared Photodetectors and Studies of Enhancing Light Coupling and Radiation Effects in QWIPs ***Final Report, 2 Mar. 1998 - 30 Jun. 1999***

Li, Sheng S.; Jul. 1999; 128p; In English

Contract(s)/Grant(s): F29601-98-C-0022; AF Proj. 8809

Report No.(s): AD-A373236; AFRL-VS-TR-1999-1100; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

In this report, we present the design, fabrication, and characterization of several high performance multi-color and broadband quantum well infrared photodetectors (QWIPs) for both MWIR and LWIR applications. The report covers tasks performed during the period from March 3, 1998 through July 10, 1999. A very high sensitivity, high-strain, multi-color triple-coupled (TC-) QWIP using InGaAs/AlGaAs/InGaAs material systems has been developed in this project for LWIR multi-color detection. A two-stack InGaAs/AlGaAs/InGaAs TC-QWIP and InGaAs/AlGaAs TC-QWIP has been developed for the LWIR and MWIR dual-band detection. In addition, a high-strain InGaAs/GaAs TC-QWIP with and without two-dimensional (2-D) grating coupler has been designed, fabricated, and characterized for the LWIR detection. This device shows very high responsivity under 450 back-illumination. Several broadband (BB-) QWIPs have been developed for the LWIR detection. These include (1) two-stack, five-well n-type InGaAs/AlGaAs broadband (BB-) QWIPs with 3- and 7-period QWs in the unit cell, (2) 3- and 4-well n-type BB-QWIPs, and (3) two 3- and 4- well p-type BB-QWIPs. In addition, a three-stack InGaAs/AlGaAs/InGaAs BB TC-QWIP grown on GaAs substrate has been developed for LWIR detection, which has a FWHM spectral bandwidth twice larger than the single-stack TC-QWIP. Finally, a MWIR InGaAs/InAlAs TC-QWIP grown on InP substrate, operating up to T = 116K with excellent device performance, has also been demonstrated. Four journal papers and six conference papers have been published and presented from this work.

DTIC

Quantum Wells; Color; Infrared Radiation; Infrared Detectors; Photometers; Radiation Effects; Couplings

20000031378 Department of the Navy, Washington, DC USA

Optically Activated Back-to-Back Pin Diode Switch Having Exposed Intrinsic Region

Sun, Chen-Kuo, Inventor; Chang, Ching T., Inventor; Albares, Donald J., Inventor; Nguyen, Richard, Inventor; Jul. 06, 1999; 5p; In English

Patent Info.: Filed 14 Nov. 97,; US-Patent-Appl-SN-08,970,328; US-Patent-5,920,065

Report No.(s): AD-D019581; No Copyright; Avail: US Patent and Trademark Office, Microfiche

The optoelectronic switch of the present invention comprises two PIN diodes connected in series with opposed polarity having their intrinsic regions coupled to a light source for maintaining both diodes in the conductive state while the light source is on and in the non-conductive state while the light source is off.

DTIC

Junction Diodes; P-I-N Junctions; Electro-Optics; Patents; Inventions

20000031386 Department of the Navy, Washington, DC USA

Cold Field Emitters With Thick Focusing Grids

Tang, Cha-mei, Inventor; Ting, Antonio C., Inventor; Swyden, Thomas A., Inventor; Sep. 21, 1999; 20p; In English; Supersedes , AD-D016334.

Patent Info.: Filed 25 Feb. 94,; US-Patent-Appl-SN-08-201-963; US-Patent-5-955-849

Report No.(s): AD-D019590; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A field emitter for producing an electron beam includes at least one cold cathode unit. Each of the cold cathode units includes an emitter cone having an emitter tip and a gate spaced apart from the emitter tip for extracting electrons from the emitter tip in a propagation direction upon application of a positive dc voltage on the gate with respect to the emitter tip. The gate forms a gate cavity for propagation of the extracted electrons therethrough. Each of the cold cathode units further includes at least one lens electrode disposed further in the propagation direction from the emitter tip than the gate the at least one lens electrode forming at least one lens cavity for propagation of the extracted electrons therethrough. The at least one lens electrode is for focusing the extracted electrons in part of the gate cavity, part of the at least one lens cavity, and part of the region there between.

DTIC

Emitters; Electron Beams; Tube Grids; Cold Cathodes; Tunnel Cathodes; Cold Cathode Tubes

20000031602 Department of the Navy, Washington, DC USA
Frequency Selective Surface Integrated Antenna System
Hu, Thinh Q., Inventor; Logan, James C., Inventor; Rockway, John W., Inventor; Jun. 29, 1999; 11p; In English
Patent Info.: Filed 8 Sep. 95,; US-Patent-Appl-SN-08,525,802; US-Patent-5,917,458
Report No.(s): AD-D019571; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A frequency selective surface integrated antenna is provided which comprises a frequency selective surface, including an electrically non-conductive substrate and an electrically conductive layer, mounted to the substrate and having a pattern of apertures; and an antenna integrated in the frequency selective surface.

DTIC

Frequencies; Antenna Design; Antenna Components

20000031603 Department of the Navy, Washington, DC USA
Standardized Modular Antenna System
Saleem, David J., Inventor; Aug. 17, 1999; 7p; In English
Patent Info.: Filed 14 Apr. 97,; US-Patent-Appl-SN-08,828,229; US-Patent-5,399,526
Report No.(s): AD-D019574; No Copyright; Avail: US Patent and Trademark Office, Microfiche

For use in a submarine, an easily reconfigurable mast antenna system disposed within an RF transparent radome is disclosed where modularly, interchangeably designed antenna of the system are detachably attached to each other via an electronic interface connector and to a carrier backbone, RF, DC and fiber optic cables transmit signals to antennas operating in the range of 5 kHz to 18 GHz.

DTIC

Standardization; Antenna Design

20000031609 Aerojet-General Corp., Azusa, CA USA
Integrated Advanced Microwave Sounding Unit-A (AMSU-A). Engineering Test Report: Radiated Emissions and SARR, SARP, DCS Receivers, Link Frequencies EMI Sensitive Band Test Results, AMSU-A2, S/N 108, 08
Valdez, A., Aerojet-General Corp., USA; March 2000; 110p; In English
Contract(s)/Grant(s): NAS5-32314
Report No.(s): AEROJET-11654; CDRL-207; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This is the Engineering Test Report, Radiated Emissions and SARR, SARP, DCS Receivers, Link Frequencies EMI Sensitive Band Test Results, AMSU-A2, S/N 108, for the Integrated Advanced Microwave Sounding Unit-A (AMSU-A).

Author

Advanced Microwave Sounding Unit; Microwave Sounding; Remote Sensors; Earth Observing System (EOS); Remote Sensing; EOS Data and Information System

20000031673 Department of the Navy, Washington, DC USA
Flexible Ferrite Loaded Loop Antenna Assembly
Gerhard, Erich M., Inventor; Aug. 03, 1999; 9p; In English; Supersedes US-Patent-Appl-SN-08696586, AD-D018178.
Patent Info.: Filed 24 Jul. 96,; US-Patent-Appl-SN-08,696,586; US-Patent-5,933,117
Report No.(s): AD-D019552; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A buoyant loop antenna, deployable along a cable, includes a core region comprising a plurality of annular ferrite beads. These annular shaped beads include a center hole and generally concave first end and a generally convex second end. The ferrite beads are aligned with the concave end of one bead against the convex end of another bead. This allows the cable to flex while the beads maintain contact with each other, providing flexibility and resistance to crushing. The core region has a loop wire wrapped helically around it, forming the loop antenna. The loop wire element starts and ends at the same end of the core region, forming a loop. This loop allows transmission and reception in and athwart (side to side) direction. This novel wire loop antenna can be combined with a straight wire antenna (which provides reception in a fore and aft direction) to provide an omni-directional cable antenna assembly.

DTIC

Ferrites; Patents; Loop Antennas; Electric Wire

20000031674 Department of the Navy, Washington, DC USA

Apparatus for Contactless Measurement of the Electrical Resistance of a Conductor

Richardson, Robert E., Inventor; Jul. 13, 1999; 7p; In English; Supersedes US-Patent-Appl-SN, AD-D018615.

Patent Info.: Filed 3 Jun. 1997; US-Patent-Appl-SN-08,869,320; US-Patent-5,923,175

Report No.(s): AD-D019551; No Copyright; Avail: US Patent and Trademark Office, Microfiche

An apparatus for contactlessly measuring (he electrical resistance per unit length of a low-resistance test conductor (e.g., wire or cable) at a selected measurement frequency, which includes a coaxial cavity structure having a central cavity region defined by opposed first and second outer conductor sections and a center conductor, wherein the test conductor comprises the center conductor.

DTIC

Electrical Resistance; Electric Conductors; Patents

20000031679 George Mason Univ., Dept. of Electrical and Computer Engineering, Fairfax, VA USA

The Application of Free-Space Optical Interconnects to High Performance Communication Decoding ***Final Report, 1 Jun. 1996-30 Nov. 1998***

Haney, Michael W.; Nov. 30, 1998; 34p; In English

Contract(s)/Grant(s): F49620-96-1-0282; AF Proj. 1651

Report No.(s): AD-A373463; AFRL-SR-BL-TR-00-0030; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Development of the ”Two-bounce” interconnection concept, that is based on topological transformations, and which minimizes the smart pixel resource required for the Viterbi architecture and has wider implications for free-space optical interconnects. Completion of the initial optomechanical evaluation system for the Viterbi system which used fiber-coupled arrays to simulate the eventual smart pixel array I/O. Development of general scaling laws for free-space optical systems, which show the size, volume, power consumption and latency benefits of free-space optics for high bisection bandwidth interconnection applications, such as the Viterbi application. Development of a novel hybrid macro/micro-optical scheme that simplifies the optical design while minimizing critical aberrations in the system. The following sections detail the key results for each of these progress area. The progress made in this program has resulted in 3 refereed journal papers and 6 conference papers.

DTIC

Optical Communication; Optical Equipment; Optical Interconnects; Smart Structures

20000031708 Department of the Navy, Washington, DC USA

Microstrip Dual Mode Elliptic Filter with Modal Coupling Through Patch Spacing

Grounds, Preston W., III, Inventor; Zaki, Kawthar A., Inventor; Aug. 17, 1999; 8p; In English; Supersedes US-Patent-Appl-SN-08802473

Patent Info.: Filed 18 Feb. 1997; US-Patent-5,939,958; US-Patent-Appl-SN-08,802,473

Report No.(s): AD-D019543; No Copyright; Avail: US Patent and Trademark Office, Microfiche

Disclosed is a planar dual mode microstrip filter with the coupling between similar modes on different patches governed by the spacing between the patches rather than by microstrip coupling lines between the patches. The patches are shaped to allow dual mode coupling. The materials used in building this filter were an alumina substrate with gold metalization. The filter is encased in a conducting box made from a conducting material. One advantage of the proximity coupled structure is that it reduces the number of parts, complexity and allows the filter to be realized in a smaller space than in previous dual mode designs. This filter is useful in satellite communications, radar, and cellular communications. High temperature superconductor materials can be user in a planar microstrip form.

DTIC

Microstrip Transmission Lines; Coupled Modes; Metallizing

20000031729 Department of the Navy, Washington, DC USA

Electro-Optic Modulator and Method

Dennis, Michael L., Inventor; Burns, William K., Inventor; Duling, Irl N., III, Inventor; Sep. 21, 1999; 7p; In English

Patent Info.: Filed 31 Jul. 96,; US-Patent-Appl-SN-08,690,135; US-Patent-5,956,171

Report No.(s): AD-D019572; No Copyright; Avail: US Patent and Trademark Office, Microfiche

An optical intensity modulator which uses a Sagnac interferometer having an electro-optic phase modulator therein. An electric modulation signal is delivered to the modulator, and the latter is selected so that the phase velocity of optical and electrical signals are comparable in it. This causes the optical signal from one interferometer arm to copropagate through the modulator with the electrical signal, increasing interaction time with it, and causes the optical signal from the other arm to counterpropagate with

the electric signal, reducing interaction time. In addition to phase modulating the optical signals by the electrical signal, the electro-optic effect in the modulator phase shifts the optical signals with respect to one another, permitting them to form a non-zero interference pattern, whose intensity corresponds to the electrical signal. In one embodiment, the interferometer has a non-reciprocal device to impose a constant phase difference between the counterpropagating optical signals, which permits one to place the system's setpoint to any arbitrary point on the system's transmissivity versus phase response. e.g. large signal and/or linear response.
DTIC
Electro-Optics; Modulation; Modulators; Patents

20000031730 NASA Goddard Space Flight Center, Greenbelt, MD USA
Germanium JFET for Cryogenic Readout Electronics
Das, N. C., Raytheon/ITSS, USA; Monroy, C., Raytheon/ITSS, USA; Jhabvala, M., NASA Goddard Space Flight Center, USA; Shu, P., NASA Goddard Space Flight Center, USA; Nov. 23, 1999; 10p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The n-channel Germanium junction field effect transistor (Ge-JFET) was designed and fabricated for cryogenic applications. The Ge-JFET exhibits superior noise performance at liquid nitrogen temperature (77 K). From the device current voltage characteristics of n-channel JFETs, it is seen that transconductance increases monotonically with the lowering of temperature to 4.2 K (liquid helium temperature).
Author
Germanium; JFET; Cryogenics; Readout; Electric Potential

20000031743 Department of the Navy, Washington, DC USA
Waterproof Quick Disconnect Slip Ring Device
Stout, Brian, Inventor; Jordan, Joseph, Inventor; Peebles, Robert, Inventor; Aug. 10, 1999; 10p; In English; Supersedes US-Patent-Appl-SN-837170
Patent Info.: Filed 14 Apr. 1997; US-Patent-Appl-SN-837,170; US-Patent-5,934,911
Report No.(s): AD-D019529; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A waterproof quick disconnect slip ring device includes a female component attached to a rotating component, a male component attached to a stationary component and removably inserted into a cavity of the female component so as to permit relative rotation between the female and male components, and an annular dynamic seal provided between the female and male components so as to provide a dynamic watertight seal there between as the female and male components rotate relative to one another. The female and male components respectively have first and second electrical conductor arrangements which are electrically coupled together and maintained in the electrical coupled relationship as the female and male components and the first and second electrical conductor arrangements therewith undergo rotation relative to one another. The slip ring device also includes an annular hub and a pair of end caps with annular static seats. The annular hub has a pair of spaced apart opposite end portions and a longitudinal opening extending there between with the female component being removably inserted into and secured to the annular hub. The end caps and annular static seals are applied respectively to outer end portions of the male component and annular hub so as to provide water tight static seals at opposite ends of the slip ring device.
DTIC
Patents; Waterproofing

20000031745 Department of the Navy, Washington, DC USA
Electroluminescent Arrays Layered to Form a Volumetric Display
Whitesell, Eric J., Inventor; Jul. 27, 1999; 8p; In English
Patent Info.: Filed 19 Sep. 96,; US-Patent-Appl-SN-08,715,979; US-Patent-5,929,572
Report No.(s): AD-D019533; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A solid state 3-D display comprises an array of voxels made of an electroluminescent material arranged in a matrix of a transparent material. Transparent electrodes are formed in the matrix to form electrical connections to each voxel. The transparent electrodes are connected to voltage sources outside the display volume for controlling the optical output of each voxel to produce a three-dimensional image inside the display volume.
DTIC
Patents; Electroluminescence; Matrix Materials

20000031768 TRW Space and Electronics Group, Redondo Beach, CA USA
12-Bit High Dynamic Range ADC ***Monthly Report, 15 Dec. 1999-15 Jan. 2000***
Oyama, Bert K.; Jan. 15, 2000; 5p; In English
Contract(s)/Grant(s): N00014-97-C-2033
Report No.(s): AD-A373378; TRW-67219; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

During this reporting period, assembly of engineering prototype MCMs was completed and MCM debugging performed. This report discusses the problems encountered during the process and their solutions. A photograph of a completely assembled MCM and its corresponding block diagram which illustrated the electrical contents of the 2" x 5" ceramic module is also presented.
CASI
Analog to Digital Converters; Electronic Modules; Chips (Electronics); Manufacturing

20000031878 Department of the Navy, Washington, DC USA
Multi-Stage Delta Sigma Modulator with One or More High Order Sections
Fischer, Godi, Inventor; Davis, Alan J., Inventor; Sep. 07, 1999; 9p; In English; Supersedes US-Patent-Appl-SN-08854511, AD-D018520.
Patent Info.: Filed 12 May 1997; US-Patent-5,949,361; US-Patent-Appl-SN-08,854,511
Report No.(s): AD-D019558; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A wide-band sigma-delta modulator is disclosed having a cascade of two modulators or stages, the first stage being of third or greater order and the second being of second or greater order. Both stages utilize simple ternary quantizers to avoid linearity problems associated with the digital to analog converters in the feedback paths of the modulators and to maintain stable operation. Additional zeros are placed in the noise transfer functions of third or higher order stages by means of additional feedback loops between the output of the third integrator and the second summing junction to maximize the dynamic range. The new topology significantly enhances the dynamic range of the system while hardly affecting the circuit's sensitivity with regard to some non-idealities such as finite amplifier open-loop gains or capacitor ratio mismatches. The excess dynamic range gained by these additional zeros is substantial and independent of OSR, hence, the present invention is particularly useful in wide-band applications where the OSR is inherently low. by employing only two cascaded stages, amplifier gain and capacitor ratio matching requirements are kept reasonably low.
DTIC
Broadband; Delta Modulation; Digital to Analog Converters; Analog to Digital Converters; Patents

20000031883 California Univ., Dept. of Electrical Engineering and Computer Science, Berkeley, CA USA
Monolithic and Vertical Integration of Resonant Tunneling Diodes and FETs for Cellular Neural Networks ***Annual Report***
Chua, Leon O.; Feb. 2000; 4p; In English
Contract(s)/Grant(s): N00014-99-1-0339
Report No.(s): AD-A373337; 442427-23110; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Advances in research have been made in the following areas: (1) Exhaustive search and study of the literature on RTD-FET based circuits and their functionality. (2) Development of a SPICE model for the RTD that can be used for realistic simulations of RTD based CNN circuitry. (3) Detailed study of the simple CNN cell circuit that is outlined in the project proposal. (4) Advances in the development of circuits that are programmable and fully exploit the capabilities of the RTD.
DTIC
Neural Nets; Resonant Tunneling; Vertical Distribution

20000032042 California Univ., Berkeley, CA USA
Analysis of Ultra-High Speed, High Temperature Superconductor (HTS) Digital Circuits ***Final Report, 31 Oct. 1997-30 Sep. 1999***
van Duzer, Theodore; Jan. 18, 2000; 4p; In English
Contract(s)/Grant(s): N00014-98-1-0084; Proj-98PRO1761-00
Report No.(s): AD-A373697; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The purpose of this research was to determine the expected yields and bit error rates of HTS digital circuits operated at tens of gigahertz at various temperatures. This was done by using device parameters from TRW, Conductus, and Northrup Grumman for state-of-the-art devices. The circuits studied included two rapid-single-flux-quantum (RSFQ) T flip-flop circuits. One (with 14 Josephson junctions) included estimated undesirable parasitic inductances and other was assumed free of parasitics. We also analyzed a three-stage counter made of a cascade of the T flip-flops with parasitics with 38 junctions. We conducted Monte Carlo simulations and evaluated the bit-error rates (BER) at various temperatures. Yield calculations were made for operation at a

number of multi-gigahertz frequencies. For higher frequency operation, the results improved strongly with higher assumed products of critical current and normal-state resistance (lcRn). For 50 GHz operation with lcRn = 0.5 mV, we compared the yield for a T flip-flop with that of the three-stage counter (70% vs. 34%). Bit-error-rate calculations suggest that operating temperature must be is less than 20-30 K for a BER is less than 10 -6.
DTIC
Digital Electronics; High Temperature Superconductors; Logic Circuits; Monte Carlo Method; Operating Temperature; Flip-Flops

20000032043 Mitsubishi Electric Corp., Tokyo, Japan
22GHz, 300W High-Efficiency Space TWT for Future DBS
Aoki, H., Mitsubishi Electric Corp., Japan; Momota, K., Mitsubishi Electric Corp., Japan; Yamamoto, T., Mitsubishi Electric Corp., Japan; Nakagawa, H., Japan Broadcasting Corp., Japan; Hoshino, H., Japan Broadcasting Corp., Japan; Morishita, Y., Japan Broadcasting Corp., Japan; Ide, H., Toshiba Corp., Japan; Tanaka, Y., Toshiba Corp., Japan; Sugimori, K., Toshiba Corp., Japan; [1992]; 6p; In Japanese; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche

Recent development work concerning 22 Ghz band,300 W class traveling wave tube (TWT) for future broadcasting satellites is described. The TWT is equipped with a velocity-tapered coupled-cavity slow-wave structure and a radiation-cooled 4-stage depressed collector for efficiency improvement. The results of more than 330 W output signal power with 50-52 % overall efficiency were obtained in the 22.5-22.9 GHz frequency range. The test tube weighs less than 5 kg.
Author
Traveling Wave Tubes; Direct Broadcast Satellites; Superhigh Frequencies

34
FLUID MECHANICS AND THERMODYNAMICS

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

20000027684 Patras Univ., Dept. of Mechanical Engineering, Greece
Turbulent Mixing Processes in a Swirling-Multiple Jet Confined Crossflow Configuration
Kalogirou, I. D., Patras Univ., Greece; Bakrozis, A. G., Patras Univ., Greece; Papailiou, D. D., Patras Univ., Greece; Sep. 10, 1999; 7p; In English
Report No.(s): AD-A373319; ISABE-99-7261; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

The aim of the present work is to provide global insight on the turbulent mixing processes typically occurring in a rectangular perspex mixing module simulating a sector of an annular RQL gas turbine combustor, through an experimental investigation of non reacting multiple jet mixing with a confined swirling crossflow. The RQL (Rich burn - quick Quench - Lean burn) staged combustion concept has been proposed as one of the candidate technologies towards reducing NOx emissions in gas turbine combustion systems. Mean and fluctuating momentum and scalar field distributions, mixing rate and standard deviation were determined in a number of different test cases obtained by parametric variation of flow and geometric configuration conditions. The results clearly indicate the sensitivity of the attained mixing quality on the particular flow arrangement, the momentum flux ratio and the effect of swirl induced in the primary zone.
DTIC
Turbulent Flow; Gas Turbines; Jet Mixing Flow; Cross Flow; Fluid Jets; Turbulent Mixing; Burning Rate

20000027691 Department of the Navy, Washington, DC USA
Device for Interactive Turbulence Control in Boundary Layers
Snarski, Stephen R., Inventor, Department of the Navy, USA; Aug. 24, 1999; 16p; In English; Supersedes US-Patent-Appl-SN-08/903274
Patent Info.: Filed 7 Jul. 1997; US-Patent-Appl-SN-08/244,204; US-Patent-5,941,481
Report No.(s): AD-D019532; No Copyright; Avail: Defense Technical Information Center (DTIC)

An electro-magnetohydrodynamic (EMHD) transducer that detects and manipulates the velocity of a near wall fluid below a turbulent boundary layer includes a magnetic field generator to provide a magnetic field near a surface exposed to the fluid is reviewed. A pair of spaced electrodes are disposed within the magnetic field. A controller coupled to the electrodes detects the electric field induced by the motion of a conductive fluid relative to the surface The controller selectively activates the electrodes to generate an applied electric field between the electrodes when the detected field exceeds a threshold. The Lorentz force

generated in response to the applied electric field and the magnetic field either decelerates or accelerates the motion of the conductive fluid to prevent the formation of turbulent events.
DTIC
Magnetohydrodynamics; Turbulent Boundary Layer; Transducers; Turbulent Flow; Fluid Boundaries

20000028368 Aerospace Corp., Los Angeles, CA USA
A Method for Separating Shock Wave Motion and Turbulence in LDV Measurements
Palko, C. W., Aerospace Corp., USA; Dutton, J. C., Illinois Univ. at Urbana-Champaign, USA; Experiments in Fluids; 1999; Volume 26, pp. 358-370; In English
Contract(s)/Grant(s): DAAH04-93-G-0226
Report No.(s): AD-A369992; ARO-36425.8-EG; Copyright; Avail: Issuing Activity, Microfiche, Hardcopy

Two-component laser Doppler velocimetry (LDV) measurements were made in a planar, two-dimensional flow containing in unsteady oblique shock wave formed by the convergence of two supersonic streams past a thick plate. High-speed wall pressure measurements locate the shock wave and, consequently, allow separation of the effects of shock wave motion from the turbulence fluctuations in the LDV measurements of the shock-separated free shear layer. In the current flow isolating the large-scale changes in the position of fix shock from the turbulence primarily reduces the experimental scatter rather than significantly changing the shapes or magnitudes of the turbulent stress profiles. Changes in the direction of shock motion do not significantly affect the mean velocity, but do affect the turbulent stresses.
Author
Shock Waves; Turbulence; Two Dimensional Flow; Velocity Measurement

20000028369 Illinois Univ. at Urbana-Champaign, Dept. of Mechanical and Industrial Engineering, Urbana, IL USA
Planar Visualizations of Large-Scale Turbulent Structures in Axisymmetric Supersonic Separated Flows
Bourdon, Christopher J., Illinois Univ. at Urbana-Champaign, USA; Dutton, J. Criag, Illinois Univ. at Urbana-Champaign, USA; Pysics of Fluids; January 1999; ISSN 1070-6631; Volume 11, No. 1, pp. 201-213; In English
Report No.(s): AD-A369993; ARO-36425.7-EG; Copyright; Avail: Issuing Activity, Microfiche, Hardcopy

The spatial evolution of large-scale turbulent structures in the shear layer of an axisymmetric, supersonic separated flow has been investigated. The experimental diagnostic used was planar visualization of condensed ethanol droplets that were suspended in the supersonic free stream. Spatial correlation analyses of large ensembles of images show that the mean side-view structure is highly strained and elliptical in shape and is inclined toward the local free stream direction. It is also shown that the effect of lateral streamline convergence for this axisymmetric case causes a reduction in side-view structure size and eccentricity at the reattachment point as compared to the planar case. End-view structures are wedge shaped, wider on the free-stream side than on the recirculation region or developing wake side. It is concluded that the wedge shape is caused by the axisymmetric confinement of the shear layer as it approaches the wake centerline The average number of structures present in the end-view plane decreases significantly from 10-14 at recompression to 4-5 in the developing wake region. Evidence of an amalgamation of end-view structures in the imaging at the reattachment point illustrates one of the mechanisms responsible for this reduction.
Author
Axisymmetric Flow; Supersonic Flow; Turbulent Flow; Flow Visualization; Separated Flow

20000028391 American Univ., Beirut Lebanon
A Unified Formulation of the Segregated Class of Algorithms for Multi-Fluid Flow at All-Speeds ***Final Report***
Moukalled, F.; Darwish, M.; Nov. 25, 1999; 92p; In English
Contract(s)/Grant(s): F61775-99-WE094
Report No.(s): AD-A373196; EOARD-SPC-99-4094; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report results from a contract tasking American University of Beirut as follows: It has been determined that the segregated class of algorithms and the many techniques developed for single fluid flow, has not been fully extended to multi-fluid flows. Thus the main objectives of this work are: (1) to extend the applicability of the available segregated class of algorithms for single fluid flow at all speeds to multi-fluid flow at all speeds; (2) to derive these algorithms using a unified, compact, and easy to understand notation that can be expanded systematically to yield the coefficients of the pressure correction equation, thus facilitating the implementation of these algorithms to a wider audience within the Computational fluid Dynamics (CFD) community; (3) to explain the philosophies behind these algorithms and to pinpoint their similarities and differences.
DTIC
Algorithms; Multiphase Flow; Mass Flow; Subsonic Flow; Hypersonic Flow

20000028394 National Technical Univ., Lab. of Thermal Turbomachines, Athens Greece

Effect of Wall Rotation on the Performance of a High-Speed Compressor Cascade with Tip Clearance

Doukelis, A., National Technical Univ., Greece; Mathioudakis, K., National Technical Univ., Greece; Papailiou, K., National Technical Univ., Greece; Sep. 10, 1999; 7p; In English

Contract(s)/Grant(s): BRPR-CT97-0610

Report No.(s): AD-A373360; ISABE-99-7267; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

In the present work, the influence of the magnitude of the relative wall speed on the performance of an annular compressor cascade with tip clearance, is examined. Five-hole probe measurements, conducted at the inlet and outlet of the cascade, are used to derive blade performance characteristics, in the form of loss and turning distributions. Characteristics are presented in the form of circumferentially mass averaged profiles, while distributions on the exit plane provide information useful to interpret the performance of the blading. Four different rotational speeds of the hub have been examined, giving the possibility to observe the dependence of performance characteristics on hub rotational speed. Increasing the rotational speed is found to improve the performance of the cascade by decreasing losses in the clearance region, while it affects the flow in the entire passage.

DTIC

Turbomachinery; Boundary Layer Flow; Compressors; Cascade Flow; Annular Flow

20000028396 Technion - Israel Inst. of Tech., Faculty of Aerospace Engineering, Haifa, Israel

Stability of Explosive Boiling of Fuel Droplets

Shusser, M., Technion - Israel Inst. of Tech., Israel; Weihs, D., Technion - Israel Inst. of Tech., Israel; Sep. 10, 1999; 11p; In English

Report No.(s): AD-A373362; ISABE-99-7279; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The paper presents a study of stability of explosive boiling, where, in addition to surface evaporation, a vapor bubble grows within a highly superheated liquid droplet, immersed in a liquid or gas medium. to get better insight into the problem two simpler but related problems are studied before the full stability problem is treated. First, the stability of an evaporating highly superheated liquid droplet is analyzed, in order to estimate the influence of the outer evaporation from the droplet surface. The linear stability of the process at the final stages of explosive boiling, when the droplet forms an expanding liquid shell, is studied next. Finally, the general case of explosive boiling stability is considered. It is shown that the process is unstable as indeed has been found in existing experiments.

DTIC

Air Breathing Engines; Drops (Liquids); Boiling

20000028398 Industria de Turbo Propulsores S.A., Aerothermal and Systems Dept., Madrid, Spain

Particle Dynamics Simulation for Aeroengine Intake Design

delaCalzada, P., Industria de Turbo Propulsores S.A., Spain; Vazquez, R., Industria de Turbo Propulsores S.A., Spain; Fernandez, F., Industria de Turbo Propulsores S.A., Spain; San Segundo, M. P., Industria de Turbo Propulsores S.A., Spain; Sep. 10, 1999; 7p; In English

Report No.(s): AD-A373365; ISABE-99-7280; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

The design of an engine intake comprising an inertial inlet particle separator is accomplished under this work. With that purpose a Navier Stokes solver is used for aerodynamics performance investigation for design and off design conditions and the particle trajectories are obtained using a post process tool. In order to obtain the particle trajectories the equations of particle dynamics are integrated following an explicit scheme. The time step limitations of the explicit method depending on the particle size and Reynolds number are discussed and some details of the methodology followed to integrate the equations on the discredited domain are given. Finally, aerodynamics results of the intake are shown and the particle trajectories for a wide range of particles sizes are obtained in order to assess the separation efficiency of the intake system.

DTIC

Turboprop Engines; Computational Fluid Dynamics; Particle Motion; Computerized Simulation; Navier-Stokes Equation

20000029439 Pennsylvania State Univ., Dept. of Mechanical Engineering, University Park, PA USA

Effects of Acoustic Oscillations on Turbulent Flowfield in a Simulated Rocket Motor

Apte, Sourabh, Pennsylvania State Univ., USA; Yang, Vigor, Pennsylvania State Univ., USA; JANNAF 35th Combustion Subcommittee Meeting; December 1998; Volume 1, pp. 497-517; In English; See also 20000029419

Contract(s)/Grant(s): N00014-95-1-1338; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Turbulent compressible flows in a simulated rocket motor with acoustic oscillations have been analyzed numerically. Emphasis is placed on the interactions between turbulence and periodic motions, and their effect on mean flow properties. The

impetus for the current work is to investigate the velocity-coupled combustion response of the propellant grain. Specifically, interactions between chamber gas dynamics and transient combustion responses of the propellants can be further explored based on present cold-flow analysis. The formulation treats the complete conservation equations of mass, momentum, and energy for the large energy-carrying turbulent structures. A stationary turbulent flowfield is first obtained and the coupling between the acoustic oscillations md turbulence are studied by imposing traveling waves over the mean flowfield. The impact of mean velocity transition and the turbulence kinetic energy transition on the turbulence structure is elucidated using time evolution of the vorticity and scalar fields. The flow in the duct undergoes three successive regimes of development governed by the injection, the turbulence, and the compressibility effect, respectively. The acoustic fields obtained in these regimes are quite different because of the turbulence-enhanced transport and dissipation rates. The shear waves obtained from periodic motions are damped in the turbulent region and serves as an additional mechanism for energy transfer to the turbulent flow. The time-averaged effect of dynamical motions associated with the turbulence production in non-stationary flowfield is different from the stationary turbulent flow indicating strong interactions with acoustic excitations. The present work is a major step towards a complete analysis of the transient combustion response of propellants to the imposed periodic oscillations in turbulent environments.
Author
Propellant Combustion; Turbulent Combustion; Turbulent Flow; Acoustic Coupling; Cold Flow Tests; Rocket Engines; Turbulence Effects; Computerized Simulation

20000029575 NASA Langley Research Center, Hampton, VA USA
Electrical Properties and Power Considerations of a Piezoelectric Actuator ***Final Report***
Jordan, T., NASA Langley Research Center, USA; Ounaies, Z., Institute for Computer Applications in Science and Engineering, USA; Tripp, J., NASA Langley Research Center, USA; Tcheng, P., NASA Langley Research Center, USA; February 2000; 14p; In English
Contract(s)/Grant(s): NAS1-97046; RTOP 505-90-52-01
Report No.(s): NASA/CR-2000-209861; NAS 1.26:209861; ICASE-2000-8; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper assesses the electrical characteristics of piezoelectric wafers for use in aeronautical applications such as active noise control in aircraft. Determination of capacitive behavior and power consumption is necessary to optimize the system configuration and to design efficient driving electronics. Empirical relations are developed from experimental data to predict the capacitance and loss tangent of a PZT5A ceramic as nonlinear functions of both applied peak voltage and driving frequency. Power consumed by the PZT is the rate of energy required to excite the piezoelectric system along with power dissipated due to dielectric loss and mechanical and structural damping. Overall power consumption is thus quantified as a function of peak applied voltage and driving frequency. It was demonstrated that by incorporating the variation of capacitance and power loss with voltage and frequency, satisfactory estimates of power requirements can be obtained. These relations allow general guidelines in selection and application of piezoelectric actuators and driving electronics for active control applications.
Author
Actuators; Piezoelectricity; Wafers; Systems Engineering; Dynamic Structural Analysis; Energy Consumption; Capacitance

20000029581 Institute for Computer Applications in Science and Engineering, Hampton, VA USA
An Accurate Curved Boundary Treatment in the Lattice Boltzmann Method ***Final Report***
Mei, Renwei, Florida Univ., USA; Luo, Li-Shi, Institute for Computer Applications in Science and Engineering, USA; Shyy, Wei, Florida Univ., USA; Journal of Computational Physics; February 2000; Volume 155, pp. 207-330; In English
Contract(s)/Grant(s): NAS1-97046; NSF EEC-94-02989; RTOP 505-90-52-01
Report No.(s): NASA/CR-2000-209854; NAS 1.26:209854; ICASE-2000-6; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The lattice Boltzmann equation (LBE) is an alternative kinetic method capable of solving hydrodynamics for various systems. Major advantages of the method are owing to the fact that the solution for the particle distribution functions is explicit, easy to implement, and natural to parallelize. Because the method often uses uniform regular Cartesian lattices in space, curved boundaries axe often approximated by a series of stairs that leads to reduction in computational accuracy. In this work, a second-order accurate treatment of boundary condition in the LBE method is developed for a curved boundary. The proposed treatment of the curved boundaries is ail improvement of a scheme due to Filippova and Hanel. The proposed treatment for curved boundaries is tested against several flow problems: 2-D channel flows with constant and oscillating pressure gradients for which analytic solutions are known, flow due to ail impulsively started wall, lid-driven square cavity flow, and uniform flow over a column of circular cylinders. The second-order accuracy is observed with solid boundary arbitrarily placed between lattice nodes. The proposed boundary condition has well behaved stability characteristics when the relaxation time is close to 1/2, the zero limit

of viscosity. The improvement call make a substantial contribution toward simulating practical fluid flow problems using the lattice Boltzmann method.
Author
Boltzmann Transport Equation; Boundary Conditions; Computational Fluid Dynamics; Mathematical Models; Curves (Geometry); Navier-Stokes Equation

20000030686 National Cheng Kung Univ., Inst. of Aeronautics and Astronautics, Tainan, Taiwan, Province of China
Three-Dimensional Unsteady Turbomachinery Flow Analysis
Chen, S. H., National Cheng Kung Univ., Taiwan, Province of China; Lee, L. C., National Cheng Kung Univ., Taiwan, Province of China; Sep. 10, 1999; 11p; In English
Contract(s)/Grant(s): NSF87-0210-D-006-003
Report No.(s): AD-A373334; ISABE-99-7283; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

A Loosely Couple Blade Row (LCBR) numerical method is developed to analyze the unsteady flow field of a three-dimensional multi-blade-row turbomachinery problem. This method allows the use of initial blade numbers for unsteady calculation and only one blade channel per blade row is used. Circumferential average approach to obtain a converged steady solution as the initial condition is adopted for unsteady calculation. Relatively, it not only maintains the blade configuration, but is also computationally more efficient. The numerical method used is a compressible viscous finite volume algorithm solving Reynolds averaged Navier-Stokes equations. Artificial dissipation terms similar to that used by Jameson is adopted to suppress the numerical oscillations. Four-Stage Runge-Kutta scheme is used to advance the flow equations in time. Residual smoothing and multi-grid techniques are employed to accelerate the convergence. Baldwin and Lomax algebraic turbulent model is used for the calculation of eddy viscosity. The UTRC (United Technologies Research Center) large scale turbine is used here as the test case. The unsteady flow predicted correlates well with data. The results indicate that the unsteady turbomachinery flowfield can be solved with single flow channel of unequal pitch on each blade row.
DTIC
Unsteady Flow; Turbomachinery; Navier-Stokes Equation; Three Dimensional Flow; Reynolds Averaging; Computational Fluid Dynamics

20000030690 Institute for Computer Applications in Science and Engineering, Hampton, VA USA
Some Recent Results on Discrete Velocity Model and Ramifications for Lattice Boltzmann Equation ***Final Report***
Luo, Li-Shi, Institute for Computer Applications in Science and Engineering, USA; February 2000; 18p; In English
Contract(s)/Grant(s): NAS1-97046; RTOP 505-90-52-01
Report No.(s): NASA/CR-2000-209855; NAS 1.26:209855; ICASE-2000-7; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Some rigorous results on discrete velocity models are briefly reviewed and their ramifications for the lattice Boltzmann equation (LBE) are discussed. In particular, issues related to thermodynamics and H-theorem of the lattice Boltzmann equation are addressed. It is argued that for the lattice Boltzmann, equation satisfying the correct hydrodynamic equations, there cannot exist an H-theorem. Nevertheless, the equilibrium distribution function of the lattice Boltzmann equation can closely approximate the genuine equilibrium which minimizes the H-function of the corresponding continuous Boltzmann equation. It is also pointed out that the ”equilibrium” in the LBE models is an attractor rather than a true equilibrium in the rigorous sense of H-theorem. Since there is no H-theorem to guarantee the stability of the LBE models at the attractor, the stability of the attractor can only be studied by means other than proving an H-function.
Author
Discrete Functions; Boltzmann Transport Equation

20000031246 NOVA Research and Technology Corp., Calgary, Alberta Canada
Implementation of Drag Reduction Techniques in Natural Gas Pipelines
Weiss, Marvin H., NOVA Research and Technology Corp., Canada; 10th European Drag Reduction Working Meeting: Book of Abstracts; Mar. 24, 1997; 2p; In English; See also 20000031244; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Almost since its inception over forty years ago, NOVA Gas Transmission has been pursuing techniques to improve the flow efficiency of its high pressure natural gas pipeline system. Already more than twenty years ago, the economic benefit of epoxy coating the internal surface of large diameter pipes was recognized and implemented as new pipeline was added to the system. Moreover, since the late 1980s, NOVA has been actively researching new techniques which would further increase throughput of natural gas in the existing pipe network and improve efficiency of new installations. As a result of several research projects,

a novel technique referred to as 'scriblets' has been developed. This pressure drop reduction method involves very small grooves-about the width of a human hair-which are scratched into the internal pipe surface in the direction of flow. The mechanism of the groves is very similar to that of riblets, only that the geometrical dimensions and shape are not as precise nor as regular. Careful laboratory tests on small diameter steel pipes ((circle slash) 100 mm) indicated at least 5% less pressure drop in groved pipe when compared to the same pipe in its as-manufactured state. The grooves were scribed into the pipe wall by pulling small pigging tools, with flat wire steel brushes, through the pipe. In the past year, a full scale field trial was completed in which a flat wire brush pig, was sent through an 11.6 km section of 400 mm diameter pipe which was in operation. Flow measurements at high Reynolds number (approx. 3 x 10 (exp 6)) before and after the pigging run indicated a 10% reduction in pressure drop, likely due to the combined effect of cleaning the internal surface and the formation of scriblets. Further field tests are planned for the coming year after which plans for further implementation in NOVA's almost 22,000 km of high pressure natural gas pipe will be developed. Author

Drag Reduction; Natural Gas; Pipelines; Flow Measurement

20000031247 Politecnico di Milano, Dipt. di Ingregneria Aerospaziale, Milan, Italy

Computation of Three-Dimensional Stokes Flow Over Complicated Surfaces (3D Riblets) Using a Boundary-Independent Grid and Local Corrections

Luchini, P., Politecnico di Milano, Italy; Pozzi, A., Naples Univ., Italy; 10th European Drag Reduction Working Meeting: Book of Abstracts; Mar. 24, 1997; 1p; In English; See also 20000031244; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The research of new possibilities for improving the drag reduction characteristics of riblet surfaces induced Bechert's group in Berlin, a couple of years ago, to experiment with 3d riblet geometries, in which the riblets are periodically interrupted in an alternating pattern. The rationale was that cutting the riblets might decrease the nonlinear sloshing and allow the linear viscous drag reduction mechanism to persist up to larger riblet sizes. As soon as we were informed of these experiments, we started an effort to extend the numerical calculation of viscous protrusion heights to 3d geometries. The preliminary results of this effort, which we presented at the last EDRM (European Drag Reduction Meeting) in Ravello, gave the qualitative indication that an improvement (although probably a modest one) could be hoped for by changing slightly the fill-to-empty ratio of the riblets used in the experiment. However, our 3d Stokes-flow program was not at the time capable to operate with the exact geometry used in the experiments, but only with a qualitatively similar one. The subsequent trimming and perfecting of our computation led to a general and quite unconventional numerical method for studying 3d viscous flow over complicated surfaces which can be applied to a much wider range of problems. We shall, in this meeting, present our method, taking 3d riblets as an example. We shall also give results containing the longitudinal and transverse protrusion heights for several 3d riblet profiles, including the precise geometry used in Bechert's experiments.

Author

Three Dimensional Flow; Navier-Stokes Equation; Riblets; Boundary Conditions; Grid Generation (Mathematics); Computation

20000031248 Humboldt Univ., Lab. for Biofluidmechanics, Berlin, German Democratic Republic

Measurement of Flow Structures in a Turbulent Boundary Layer Over Smooth and Riblet Surfaces

vanderHoeven, J. G. T., Humboldt Univ., German Democratic Republic; Westerweel, J., Technische Univ., Netherlands; Nieuwstadt, F. T. M., Technische Univ., Netherlands; 10th European Drag Reduction Working Meeting: Book of Abstracts; Mar. 24, 1997; 1p; In English; See also 20000031244; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

It is conjectured that riblet surfaces effect a drag reduction by organizing the structure of a turbulent flow in the near-wall region of a turbulent boundary layer. However, direct experimental observation is inconclusive, as these are based on single-point measurement probes (like LDV) or qualitative observations with conventional flow visualization. Digital particle image velocimetry (DPM is a measurement technique that yields quantitative information of the instantaneous velocity field in a planar cross-section of the flow, and it is especially based for the investigation of flow structures. We therefore decided to use this technique to make a quantitative investigation of the flow structures in a boundary layer over smooth and riblet surfaces. The measurements were carried out in a boundary layer over a flat plate in a free-surface water flow facility. The Reynolds number was about 800 (based on the free-stream velocity and the momentum thickness). One smooth and two v-shaped riblet surfaces were investigated. The dimension of the riblets was chosen in order to compare the flow over a drag reducing (s (exp +)=17), a smooth and a drag increasing (s (exp +)=27) surface. In a previous investigation it was demonstrated that DPIV can provide accurate measurements of the velocity in a turbulent pipe flow. We used in image acquisition system that can record high-resolution images (1000 x 1016 pixels) at a rate of 10 images per second with a real-time storage capacity of 262 images. In this experiment we focus on the so-called low-speed streaks, so we choose our measurement planes parallel to the wall, with

a view area of approximately 350 x 350 1 (exp +2). This configuration yields the streamwise and spanwise velocity components with a spatial resolution of 5 1 (exp +) (i.e., 3782 velocity measurements per image), and with an accuracy of about 1% of the mean streamwise velocity. In order to obtain accurate measurements of the flow statistics me also carried out with measurements with LDV; this also allows us to validate the DPIV results.
Author
Turbulent Boundary Layer; Riblets; Surface Water; Flow Measurement; Turbulent Flow

20000031249 Institute of Theoretical and Applied Mechanics, Novosibirsk, Russia
Effect of Riblets on Flow-Structures at Laminar-Turbulent Transition and Simulation of Their Influence on Turbulent Boundary Layer
Kozlov, V. V., Institute of Theoretical and Applied Mechanics, Russia; 10th European Drag Reduction Working Meeting: Book of Abstracts; Mar. 24, 1997; 1p; In English; See also 20000031244; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

In the first part of the lecture the comparison of riblet influence on turbulent boundary layer (laminar sublayer) and some structures at laminar-turbulent transition is carried out. Then, the results of an experimental study on the influence of riblets on various structures of the laminar-turbulent transition in the Blasius boundary layer in subsonic flow such as two-dimensional Tollmien-Schlichting waves and longitudinal vortex structures of the Gortler-like or cross flow-like vortices, A-vortices and vortices excited in the wake behind a roughness is presented. It is shown that triangular riblet profiles mounted in the direction of the flow result in an unfavorable influence on the development of two-dimensional Tollmien-Schlichting waves. On the other hand, riblets were also found to significantly affect the development of non-linear wave packets (A-vortices) giving a slower growth of their intensity and delaying their transformation into the turbulent spots. The present effect of riblets on the development of a crossflow-like single vortex and Gortler-like vortices lead up to reduction of their intensity, resulting in slow damping of the secondary traveling waves and the flow remains laminar throughout the studied region. The present riblets inhibit the transition to turbulence in the wake behind a roughness. The possibility to use ”active riblets” is discussed.
Author
Riblets; Laminar Flow; Turbulent Boundary Layer; Boundary Layer Flow; Computerized Simulation

20000031250 Eidgenoessische Technische Hochschule, Inst. of Hydromechanics and Water Resources Management, Zurich, Switzerland
A Critical Discussion of the So-Called ’Momentum Deficit’ of Drag Reducing Flows
Gyr, A., Eidgenoessische Technische Hochschule, Switzerland; Tsinober, A., Tel-Aviv Univ., Ramat-Aviv, Israel; 10th European Drag Reduction Working Meeting: Book of Abstracts; Mar. 24, 1997; 2p; In English; See also 20000031244; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Turbulent flows of dmg reducing fluids (even super-diluted) exhibit the so-called ”momentum deficit”. This deficit is manifested in that the total stress is larger than (i.e. not balanced by) the sum of the Reynolds stress and the mean viscous stress, the latter calculated assuming the fluid possessing its Newtonian viscosity. Since there is no reason whatsoever to doubt the momentum balance the ”momentum deficit” cannot be considered as real deficit and is a clear indication that drag reducing fluids are essentially Non-Newtonian in turbulent flow state, though in many laminar flows they behave almost as Newtonian. Two sets of data acquired in flows with polymer (100 ppm Pr2360) and surfactant (1.9 mMol/IC14TASal at 20 C) additives at maximum drag reduction were used to investigate this ’momentum deficit’ in more detail.
Author
Drag Reduction; Momentum; Turbulent Flow

20000031251 Carl von Ossietzky Univ., Fachbereich Physik, Oldenburg, Germany
Drag Reduction in a Turbulent Shear Flow Based on the Reduced Wave Vector Set Approximation
Becker, Torsten, Carl von Ossietzky Univ., Germany; Eckhardt, Bruno, Marburg Univ., Germany; 10th European Drag Reduction Working Meeting: Book of Abstracts; Mar. 24, 1997; 1p; In English; See also 20000031244; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We employ the reduced wave vector approximation. We focus on a corotational Maxwell fluid and a special case of the transversely isotropic fluid. Due to the sparing use of computer resources the model permits relaxation into the statistically stationary state of the flow and measurement of statistical averages as the flow rate and the energy dissipation within a reasonable amount of computing time. We present results identifying the anisotropic fluid as a drag reducer. The Maxwell fluid on the other

hand dissipates more energy than the usual Newtonian fluid at the same flow rate. In addition to gross flow properties we show results concerning the turbulence statistics.
Author
Drag Reduction; Shear Flow; Turbulent Flow; Approximation

20000031252 Academy of Sciences (USSR), Inst. of Thermophysics, Novosibirsk, USSR
Influence of Molecular Mass of PEO on Virk Ultimate Drag Reduction
Kulik, V. M., Academy of Sciences (USSR), USSR; 10th European Drag Reduction Working Meeting: Book of Abstracts; Mar. 24, 1997; 1p; In English; See also 20000031244; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The experimental results of investigation of drag reduction change along the tube for PEO (Polyethylene Oxide)- solutions with different molecular mass are presented. The presence of drag reduction growth, maximum of drag reduction and degradation slope is shown. The method of calculation of hydrodynamic friction based on measuring of pressure drop is analyzed. It is shown, that contribution to pressure drop from kinetic energy of flow can be considerable. The method of correction is based on calculation of kinetic energy coefficient for Bernoulli equation is suggested. The maximum drag reduction does not depend on molecular mass of PEO in studied region (0.8-3.25 mln) and is close to ultimate value. The increase of molecular mass shifts the place of maximum drag reduction appearance to the end of tube. He obtained results widen the range of application of Virk ultimate drag reduction law.
Author
Polyethylenes; Drag Reduction; Molecular Weight; Oxides

20000031253 State Marine Technical Univ., Saint Petersburg, Russia
The Boundary Layer With Slot Injection of Polymer Solutions
Amfilokhiev, W. B., State Marine Technical Univ., Russia; Barbanel, B. A., State Marine Technical Univ., Russia; Mazaeva, N. P., State Marine Technical Univ., Russia; 10th European Drag Reduction Working Meeting: Book of Abstracts; Mar. 24, 1997; 1p; In English; See also 20000031244; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The drag reduction with the help of dilute polymer solutions can be organized by injection of concentrated solution through the transversal slots. The method for the characteristics was worked out with taking into account a few factors: the influence of body size and body velocity, the quantity of injected polymer, the position of slots and their numbers. The nondimensional characteristics are found as a function of the Reynolds number and the calculation of boundary layer rate of polymer expenditure.
Author
Boundary Layers; Injection; Polymers; Slots

20000031254 State Marine Technical Univ., Saint Petersburg, Russia
Similarity Criteria for the Dilute Polymer Solutions Turbulent Flows and Generalized Formulae of Friction Factors
Artjushokov, L. S., State Marine Technical Univ., Russia; Amfilokhiev, W. B., State Marine Technical Univ., Russia; 10th European Drag Reduction Working Meeting: Book of Abstracts; Mar. 24, 1997; 1p; In English; See also 20000031244; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

An attempt to solve the problem of the drag reduction scale-up for dilute polymer solutions is undertaken. It is based on the theory of similarity for the non-Newtonian liquid and as a result the generalized formula for the friction factors are obtained. The main criterion of similarity in these formulae is the visco-elastic Reynolds number that includes the combination of usual Reynolds number and Deborah number. The formulae am proved with many experimental results.
Author
Turbulent Flow; Friction Factor; Polymers; Solutions

20000031255 Donetsk State Univ., Donetsk, Ukraine
The Effect of Polymer Additives and SAS (Surfactant Substances) on the Hydrodynamic Resistance of Liquid Flows
Stupin, A. B., Donetsk State Univ., Ukraine; 10th European Drag Reduction Working Meeting: Book of Abstracts; Mar. 24, 1997; 1p; In English; See also 20000031244; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

This paper deals with the semiempirical theory of drag reduction of liquids by polymer additives in view of a structural approach. The theory is based on the mechanism of a resonant absorption of a turbulent energy by the macromolecules of polymers, the main point of which is that in a turbulent flow a polymeric molecule will be effected by spectre of turbulent

perturbations, which, in accordance with the spectral theory of turbulence, can be represented as the superposition of periodical flat waves. In case of overlapping the spectre of its own frequencies of macromolecules by the frequencies of external turbulent perturbations there takes place resonant absorbtion of a turbulent energy, which results in the decrease of pulsation motion intensity. Taking into account orientation influence of the average motion the macromolecules of polymers will exert its main influence on the transversal pulsations of velocity, which, in its turn, results on emerging anisotrope viscosity. In view of the conception of anisotrope viscosity we have constructed non-layer, two-and-three-layer models, which enabled us to calculate the velocity profiles and hydrodynamic resistance coefficient in turbulent flows of polymer solutions, including the maximum drag reduction. 2. We have analyzed the results of practical use of polymer additives and SAS (Surfactant Substances) in fire-extinguishing, for impulse hydrodestruction and continuous hydrocutting of various hard materials (rocks, coal, metals, plastics, etc.). For this purpose on the basis of hydrodynamically action polymer-polyethylenoxide (PEO) we have elaborated hard water dissoluble polymeric compositions (briquettes), which have an increased mass output and make it possible to get hydrodynamically active solutions at short intervals of time. The results of natural tests of the elaborated briquettes showed that the efficiency of work of fire-extinguishing systems, hydrocutting processes and hydrodestruction of hard materials increases greatly.
Author
Additives; Surfactants; Liquid Flow; Hydrodynamics; Polymers; Flow Resistance

20000031256 Academy of Sciences (USSR), Inst. of Thermophysics, Novosibirsk, USSR
The Promising Study of Water-Soluble Coatings for Drag Reduction
Semenov, B. N., Academy of Sciences (USSR), USSR; 10th European Drag Reduction Working Meeting: Book of Abstracts; Mar. 24, 1997; 1p; In English; See also 20000031244; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The water-soluble polymeric coatings are tempting as passive means for drag reduction since they don't need additive volumes and energy expenses for their use. The following factors of the coating action on near-wall flows were considered in described investigations: 1) A compliance of coatings on account of their water-swollen state; 2) An injection of drag-reducing polymeric additives into flow, 3) A variable viscosity of fluid in boundary layer near the covered wall; and 4) A roughness of the coating surface. Here the duration of continuous observations of washing out of coating and its action on hydrodynamic friction, total drag and wall-pressure fluctuations was well over the duration in works of other authors (at least by two orders): the duration of drag reduction achieved 30 minutes. The used water-soluble compositions contain the high-molecular PEO and other components, secure for environment too.
Author
Drag Reduction; Solubility; Fresh Water; Plastic Coatings

20000031257 Academy of Sciences of the Ukraine, Inst. of Hydromechanics, Kiev, Ukraine
Polymers Submission Optimization with the Help of Sword-Shaped Tips
Babenko, V. V., Academy of Sciences of the Ukraine, Ukraine; 10th European Drag Reduction Working Meeting: Book of Abstracts; Mar. 24, 1997; 1p; In English; See also 20000031244; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Way of a turbulent boundary layer control with the help of the high-molecular polymeric (PEO) additives of small concentration giving unnewtonian properties to liquids, are an effective way of influence on hydrodynamic processes in a boundary layer. Such additives, in particular, reduce a level of turbulence and increase thickness of laminar sublayer resulted in significant reduction of friction resistance of a streamline surface. The effect of resistance reduction is displayed when the polymeric additives are present at a buffer zone between viscous sublayer and turbulent nucleus. There is not found out the main question: which mechanism of polymers molecules influence on the characteristics of a boundary layer and on the physical mechanism of friction reduction. The question of coherent vortical structures development in a turbulent boundary layer of polymers water solutions is completely not investigated. For realization of measurements of polymers water solutions submission influence on a boundary layer characteristics a model of rotation body was developed.
Author
Optimization; Slits; Polyethylenes; Shapes; Turbulent Boundary Layer

20000031258 Czech Technical Univ., Dept. of Hydraulics and Hydrology, Prague, Czechoslovakia
Efficiency of Drag Reduction by Surfactants and Its Limitations for District Heating Networks
Pollert, Jaroslav, Czech Technical Univ., Czechoslovakia; 10th European Drag Reduction Working Meeting: Book of Abstracts; Mar. 24, 1997; 1p; In English; See also 20000031244

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District heating world-wide gains in significance in regard to supply the space heating demand. It is able to promote a primary energy saving, environmentally acceptable and low priced energy supply. Special advantages of district heating are waste heat utilization and energy supply by combined heat and power plants. High investment costs of the heat transport and distribution network with relative small annual utilization times are disadvantages of district heating. Thus all efforts to improve the economy of heat supply is of importance. One of the promising possibilities is using drag reducing additives in district heating systems. Measurements were made using quarternary ammonium salts with their trade names: Habon G (Hoechst GmbH - FRG), Ethoquad T/13 (Akzo Chemicals - USA). Except of Habon G surfactant solutions were prepared by adding sodium salycilate solutions to thoroughly mixed quarternary ammonium salt dispersions or direct dissolving of salt in water.
Author

Drag Reduction; Surfactants; Space Heating (Buildings); Efficiency

20000031259 Ceskoslovenska Akademie Ved, Inst. of Hydrodynamics, Prague, Czechoslovakia

Drag Reduction by Surfactants and the Relevance of Their Rheological Properties

Myska, Jiri, Ceskoslovenska Akademie Ved, Czechoslovakia; Stern, Petr, Ceskoslovenska Akademie Ved, Czechoslovakia; Mutlova, Jana, Ceskoslovenska Akademie Ved, Czechoslovakia; 10th European Drag Reduction Working Meeting: Book of Abstracts; Mar. 24, 1997; 2p; In English; See also 20000031244

Contract(s)/Grant(s): GACR-103/95/0006; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Drag reducing cationactive surfactants are promising additives for district heating and cooling systems. Their capability in energy saving was shown in large scale field tests in primary heating circuits with 450 and 200mm pipes in Germany, with 200mm pipe in Denmark, in hydronic heating system of a building (12 cu m water volume) in the USA, in secondary heating system of a city district with 330 apartments (40 cu m water volume) in the Czech Republic. Further tests with cooling water in mines with 100 to 300mm pipes were done in Ukraine and also in the cooling system of a building (34 rooms) in the USA. Most often used surfactants were Dobon and Habon G of Hoechst AG [1,2,3,5], Ditalan OTS or Methoupon, Ethoquad T/13-50 and Arquad 16-50 (with sodium salicylate) of AKZO Chemie. The ability of drag reduction is often explained in connection with their rheological properties. However, It has been recently suggested that first normal stress differences as well as modulus data do not play any important role in drag reduction by surfactants. Thus drag reduction is probably not related to elasticity of the surfactant but rather to its viscous properties. Therefore the dynamic viscosity and elongational viscosity are characteristics considered to be relevant for drag reduction. In fact, viscosity behavior reveals remarkable characteristic property of the micelle network structure, the Shear Induced Structure.
Author

Rheology; Drag Reduction; Surfactants

20000031260 Ceskoslovenska Akademie Ved, Inst. of Hydrodynamics, Prague, Czechoslovakia

Velocity Profile Development Behind an Orifice Plate in the Drag Reducing Surfactant Flow

Chara, Zdenek, Ceskoslovenska Akademie Ved, Czechoslovakia; Vlasak, Pavel, Ceskoslovenska Akademie Ved, Czechoslovakia; Severa, Miroslav, Ceskoslovenska Akademie Ved, Czechoslovakia; 10th European Drag Reduction Working Meeting: Book of Abstracts; Mar. 24, 1997; 2p; In English; See also 20000031244

Contract(s)/Grant(s): GACR-103/94/1186; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The paper deals with the investigation of the influence of a sharp edged orifice plate on turbulent characteristics in drag reducing surfactant flow. By LDA (Laser Doppler Anemometer) method the profiles of velocity and RMS values of water and surfactant solution of Habon-G were taken up to the distance 4D upstream and 96D downstream from the plate. The experiments were performed in a closed recirculating hydraulic loop with horizontal glass pipe of inner diameter 39.4 mm. The LDA system was derived from Dantec system 55X and for data processing Dantec Burst Spectrum Analyzer (BSA-enhanced) was used. The surfactant we used in the experiments was Habon-G hexadecyl dimethyl hydroxyethylen ammonium 3-hydroxy-2-naphtoate (product of HOECHST Comp. FRG) at the concentration 0.095% and temperatures about 25 C. A schematic diagram of the plate is shown. The ratio of concentric hole diameter d to pipe diameter D was 0.5 (beta = 0.5). The distances of pressure tap positions were L (sub 1)= D from the upstream face of the plate and L (sub 2) = D/2 downstream from the plate. Pressure differences were measured by the differential pressure transducer Hottinger-Baldvin. Plate pressure differences in dependence on mean pipe velocity is shown. Due to the high unrecoverable pressure losses in this orifice plate and even 3.3 times less than maximum velocity for surfactant and hence the drag reduction effect in such hydraulic system with this type of the orifice plate is highly damped.

As can be seen, the experimental data of Habon-G though lie below the data of water alone, but the differences are very small (about 5%).
Author
Velocity Distribution; Orifices; Drag Reduction; Surfactants; Turbulence

20000031261 Ecole Nationale Superieure de Techniques Avancees, Paris, France
Effect of a Drag Reducing Polymer Solution in the Free Turbulence Confined by a Tip Vortex
Fruman, Daniel H., Ecole Nationale Superieure de Techniques Avancees, France; Billard, Jean-Yves, Laboratoire d'Hydrodynamique Navale, France; 10th European Drag Reduction Working Meeting: Book of Abstracts; Mar. 24, 1997; 1p; In English; See also 20000031244; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Tip vortices are very peculiar structures showing intense turbulence in the core (viscous region) as compared to the free stre= and potential region levels. Experiments conducted injecting a drag reducing polymer solution at the tip of an elliptical wing have shown significant modifications of the radial distributions of the velocities, higher moments and cross products. by analyzing the results it is shown that the effect of the polymer solution is to nearly eliminate the turbulent velocity fluctuations. The reasons for such a behaviour are discussed and their impact on the interpretation of wall turbulence damping by DR polymer additives is analyzed.
Author
Drag Reduction; Vortices; Turbulent Flow; Polymers; Solutions

20000031263 Centre d'Etudes et de Recherches, Toulouse, France
Active Control of TS Waves
Pailhas, G., Centre d'Etudes et de Recherches, France; Casalis, G., Centre d'Etudes et de Recherches, France; Gobert, J. L., Centre d'Etudes et de Recherches, France; 10th European Drag Reduction Working Meeting: Book of Abstracts; Mar. 24, 1997; 1p; In English; See also 20000031244; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The natural instabilities of flow which appear on aerospace vehicle surfaces are a source of energy dissipation increasing the drag and producing noise and vibrations, therefore they have prejudicial consequences on the performances. In the present study, we consider the so-called Tollmien-Schlichting waves which are the primary instability leading to the transition from laminar to turbulent flow. The main goal is to get a better understanding of the mechanism driving the TS waves in order to propose in the future a technique to cancel or at least of considerably reduce them as soon as they start to grow.
Author
Active Control; Tollmien-Schlichting Waves; Flow Stability; Wave Packets

20000031264 Academy of Sciences of the Ukraine, Inst. of Hydromechanics, Kiev, Ukraine
Turbulence Diffusion Mechanism on Active Deforming Surface
Voropaev, G. A., Academy of Sciences of the Ukraine, Ukraine; 10th European Drag Reduction Working Meeting: Book of Abstracts; Mar. 24, 1997; 1p; In English; See also 20000031244; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Turbulent boundary layer over rigid smooth surface have been investigated good enough, in spite of this region of turbulence is inhomogeneous and essentially anisotropic even for microscales. Energy balance in each point of the turbulent boundary layer is determined by statistic velocity and pressure within some neighborhood of this point. This neighborhood range and shape (correlation scale magnitudes along different directions) depends an integral value Re = U (sub 0) delta/v not so much as this point location about the streamlined surface, i.e. the local Reynolds number Re = u.y/v.
Author
Turbulent Boundary Layer; Diffusion; Deformation; Surface Properties

20000031266 Technical Univ. of Tallinn, Tallinn, Estonia
The Flow Turbulization by External Acoustic Field and Heat Transfer Enhancement in Laminar Gas Flow
Kaar, Harri, Technical Univ. of Tallinn, Estonia; Tiikma, Toomas, Technical Univ. of Tallinn, Estonia; 10th European Drag Reduction Working Meeting: Book of Abstracts; Mar. 24, 1997; 1p; In English; See also 20000031244; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

In this paper some heat enhancement phenomena appeared in laboratory test rig for investigation the gas combustion in auxiliary acoustic field are discussed. The test rig consists of a gas burner 5 kW (sub th), low frequency sound generator, combustion chamber and in it exit flue gas duct, where located calorimetric probe for measuring the heat transfer efficiency. The laser-Doppler anemometry was used to determine the local flue gas velocities and the rate of turbulization in the gas duct. Gas

and air supply and flue gas content were measured. The temperature difference between water supply and outlet of calorimetric probe is measured by differential thermocouple, also the water flow rate is measured. The flue gas temperature is measured by a little suction pyrometer, combined with the gas analyze probe. This data give opportunity to estimate the heat absorption by probe and to calculate the heat transfer coefficient from flue gas flow to probe. Some data on heat transfer coefficient by convection are presented. The flue gas temperature about 300 C and the intensity of sound field up to 130 dB.
Author
Acoustics; Heat Transfer Coefficients; Laminar Flow; Gas Flow; Turbulence

20000031267 Technische Univ., Dept. of Physics, Eindhoven, Netherlands
Drag Reduction and Hairpin Vortices
Zondag, H., Technische Univ., Netherlands; Voskamp, J. H., Technische Univ., Netherlands; 10th European Drag Reduction Working Meeting: Book of Abstracts; Mar. 24, 1997; 1p; In English; See also 20000031244; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The drag reducing effect of riblets has been discovered about 15 years ago and since then many papers appeared trying to explain the phenomenon or trying to optimize the shape of the riblets. Most of the work has to a certain extent an emperical character and we do not have the impression that the drag-reducing phenomenon is fully understood. This was one of the reasons to start a combined experimental and numerical study to the role of hairpin vortices in wall turbulence. Artificial hairpins were created in a laminar boundary layer both in a wind tunnel and in a water channel. In the wind tunnel extensive measurements have been carried out with an array of (single) hot wires, while visualization studies were performed in the water channel. Each of these methods only provides incomplete information. However, the combination of the investigations leads to more certainty about a number of results. Hairpin vortices are created by means of a hemisphere-type obstruction on both a grooved and a smooth plate. For the case of the riblets remarkable differences are observed: 1) The average velocity profile near the wall is less steep. 2) The areas of high speed fluid behind the obstruction and close to the wall are le= intense. 3) It seems that the wake behind the obstruction is longer. 4) The trajectory of the head of the hairpin remains closer to the.wall. Briefly, an explanation will be given for the observations.
Author
Drag Reduction; Wind Tunnel Tests; Horseshoe Vortices

20000031268 Academy of Sciences (USSR), Inst. of Thermophysics, Novosibirsk, USSR
Drag Reduction Using Gas-Bubble Saturation Under Conditions of the Longitudinal Pressure Gradient and Elevated Surface Roughness
Evseev, A. R., Academy of Sciences (USSR), USSR; Maltzev, L. I., Academy of Sciences (USSR), USSR; Malyuga, A. G., Academy of Sciences (USSR), USSR; 10th European Drag Reduction Working Meeting: Book of Abstracts; Mar. 24, 1997; 1p; In English; See also 20000031244; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The report contains experimental results: distribution of skin friction along solid walls, profiles of mean velocity and gas fraction, pressure fluctuation data on a wall. Experiments were carried out for near-wall liquid flow with gas microbubbles under conditions of the longitudinal pressure gradient and elevated surface roughness.
Author
Drag Reduction; Pressure Gradients; Surface Roughness; Bubbles

20000031347 Washington Univ., Applied Physics Lab., Seattle, WA USA
Microscale Wave Breaking and Its Effect on Air-Water Gas Transfer Using Infrared Imagery
Zappa, Christopher J.; Dec. 1999; 226p; In English
Contract(s)/Grant(s): N00014-93-1-1326; NSF-9633423
Report No.(s): AD-A373752; APL-UW-TR-9904; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

Air-sea gas exchange plays a crucial role in geochemical cycling, and a robust parameterization of the gas transfer velocity, k, is needed to improve models of global fluxes. However, the dependence of k on wind speed or wind stress has been shown to be a function of the concentration of surfactants, which are ubiquitous in nature. Laboratory measurements indicate that a wave-related mechanism regulates gas transfer because the correlation of k with wave slope is unaffected by the presence of surfactants. Microscale wave breaking has been proposed as the underlying physical process that determines k at low to moderate wind speeds. However, quantifying the effects of microscale wave breaking has been difficult because the phenomenon lacks the visible manifestation of whitecapping. Measurements here show that microscale breaking waves produce thermal surface signatures that can be quantified by infrared imaging techniques. Simultaneous and co-located infrared and wave slope imagery of laboratory wind waves show that distinct areas of the water surface where the thermal boundary layer is disrupted occur

coincidentally with waves that have a steep forward face and a dimpled bore-like crest The measurements show that these wave-related areas of enhanced surface renewal are the turbulent wakes of microscale breaking waves. The local k within the wakes, measured using the controlled flux technique, is on average 3.5 times greater than k outside the wakes.
DTIC
Air Water Interactions; Ocean Surface; Turbulent Wakes; Infrared Imagery

20000031352 Princeton Univ., Joseph Henry Labs. of Physics, NJ USA
Evidence for Vapor Bubble Luminescence, *Oct. 1999 - Jan. 2000*
Reynolds, G. T.; Jan. 14, 2000; 8p; In English
Contract(s)/Grant(s): N00014-00-1-0010
Report No.(s): AD-A372701; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A novel type of luminescence has been studied from steam vapor bubbles condensing in sea water and tap water. A possible application to the light observed at deep sea hydrothermal vents is discussed.
DTIC
Bubbles; Luminescence; Steam; Sea Water; Deep Water

20000031404 National Inst. of Standards and Technology, (BFRL), Gaithersburg, MD USA
Generalized Pressure Drop Correlation for Evaporation and Condensation of Alternative Refrigerants in Smooth and Micro-Fin Tubes
Choi, H. Y.; Kedzierski, M. A.; Domanski, P. A.; Oct. 1999; 76p; In English
Report No.(s): PB2000-103119; NISTIR-6333; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This paper presents a pressure drop correlation for evaporation and condensation in smooth and micro-fin tubes. The correlation was developed from a database consisting of the following pure and mixed refrigerants: R125, R134a, R32, R410A (R32/R125 50/50% mass), R22, R407C (R32/R125/R134a, 23/25/52% mass) and R32/R134a (25/75% mass). The new correlation was obtained by replacing the friction factor and the tube-diameter in the Bo Pierre correlation with a friction factor derived from pressure drop data for a micro-fin tube and the hydraulic diameter, respectively. The new correlation predicted the measured micro-fin data with an average residual of 10.8%, and it also predicted the pressure drop in smooth tube with an average residual of 15.0%. In addition, the correlation was used to predict pressure drop data for refrigerant/lubricant mixtures by using a viscosity-mixing rule. As a result, the new correlation predicted the measured evaporation and condensation pressure drop data for mixtures of various lubricants with R12, R22, and R134a with an average residual of 19.0%.
NTIS
Pressure Gradients; Correlation; Evaporation; Refrigerants

20000031620 NASA Lewis Research Center, Cleveland, OH USA
System for Manipulating Drops and Bubbles Using Acoustic Radiation Pressure
Oeftering, Richard C., Inventor, NASA Lewis Research Center, USA; Dec. 21, 1999; 14p; In English
Patent Info.: Filed 17 Sep. 1997; NASA-Case-LEW-16469-1; US-Patent-6,003,388; US-Patent-Appl-SN-969536; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The manipulation and control of drops of liquid and gas bubbles is achieved using high intensity acoustics in the form of and/or acoustic radiation pressure and acoustic streaming. generated by a controlled wave emission from a transducer. Acoustic radiation pressure is used to deploy or dispense drops into a liquid or a gas or bubbles into a liquid at zero or near zero velocity from the discharge end of a needle such as a syringe needle. Acoustic streaming is useful in manipulating the drop or bubble during or after deployment. Deployment and discharge is achieved by focusing the acoustic radiation pressure on the discharge end of the needle, and passing the acoustic waves through the fluid in the needle. through the needle will itself, or coaxially through the fluid medium surrounding the needle. Alternatively, the acoustic waves can be counter-deployed by focusing on the discharge end of the needle from a transducer axially aligned with the needle, but at a position opposite the needle, to prevent premature deployment of the drop or bubble. The acoustic radiation pressure can also be used for detecting the presence or absence of a drop or a bubble at the tip of a needle or for sensing various physical characteristics of the drop or bubble such as size or density.
Author
Drops (Liquids); Gases; Bubbles; Sound Waves; Acoustic Streaming; Acoustics; Radiation Pressure; Inventions; Patents

20000031625 Scripps Institution of Oceanography, La Jolla, CA USA
Vortex Generation due to Coastal and Topographic Interactions ***Final Report, 1 Oct. 1995-30 Sep. 1999***
Carnevale, George; Dec. 01, 1999; 5p; In English
Contract(s)/Grant(s): N00014-96-1-0065
Report No.(s): AD-A373418; UCSD-95-1479; UCSD-97-1584; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

For this grant, we performed two studies. In the first, the interaction of vortices with coastlines and broad topographic slopes was examined. In the second, the deviation of a coastal current due to an escarpment was investigated. The work included analytical, numerical and laboratory investigations.

DTIC

Vortex Generators; Topography; Ocean Currents; Vortices; Inviscid Flow

20000031640 Wright State Univ., Dept. of Mechanical and Materials Engineering, Dayton, OH USA
The Effect of Working Fluid Inventory on the Performance of Helically Grooved Heat Pipes ***Interim Report, 21 Aug. 1998-20 Aug. 1999***
Thomas, Scott K.; Castle, R. M.; Yerkes, Kirk L.; Sep. 1999; 107p; In English
Contract(s)/Grant(s): F33615-98-1-2844; AF Proj. 3145
Report No.(s): AD-A373450; AFRL-PR-WP-TR-1999-2115; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The results of a recently completed experimental and analytical study showed that the capillary limit of a helically-grooved heat pipe (HGHP) was increased significantly when the transverse body force field was increased. This was due to the geometry of the helical groove wick structure. The objective of the present research was to experimentally determine the performance of revolving helically-grooved heat pipes when the working fluid inventory was varied. This report describes the measurement of the geometry of the heat pipe wick structure and the construction and testing of a heat pipe filling station. In addition, an extensive analysis of the uncertainty involved in the filling procedure and working fluid inventory has been outlined. Experimental measurements include the maximum heat transport, thermal resistance and evaporative heat transfer coefficient of the revolving helically-grooved beat pipe for radial accelerations of \a(r)\ = 0.0, 2.0, 4.0, 6.0, 8.0, and 10.0-g and working fluid fills of G = 0.5, 1.0 and 1.5. An existing capillary limit model was updated and comparisons were made to the present experimental data.

DTIC

Heat Pipes; Thermal Resistance; Working Fluids; Heat Transfer

20000031703 Department of the Navy, Washington, DC USA
Micro-Electrode and Magnet Array for Microturbulence Control
Meng, James C., Inventor; Aug. 10, 1999; 11p; In English; Supersedes US-Patent-Appl-SN-08846899
Patent Info.: Filed 1 May 1997; US-Patent-5,934,622; US-Patent-Appl-SN-08,846,899
Report No.(s): AD-D019537; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A boundary layer control device for a surface which reduces turbulence by providing forces which counteract microturbulent events occurring at the surface. The microturbulent events occur periodically with a known topography and include liftup and ejection, bursting, low-speed streak and sweep topography. The device has an array of magnet and electrode cells which are arranged to correspond with the topography arrangement of the microturbulent events. The interaction of the magnetic and electric fields within the cells generate a Lorentz force which can be directed into or out of the surface depending on the relative directions of the magnetic and electric fields. Sensors on the surface determine which cells to activate and in what direction to apply the Lorentz force to precisely counteract the microturbulent events occurring at the surface. A force directed away from the surface is used to counteract a sweep event and a force directed towards the surface counteracts a liftup event. No force is applied during low-speed streak events.

DTIC

Turbulence; Boundary Layer Control; Patents; Control Equipment

20000031736 Pennsylvania State Univ., Applied Research Lab., University Park, PA USA
Computational Hydrodynamics and Control Modeling for Autonomous Underwater Vehicles ***Final Report***
Bradley, David L.; Jan. 27, 2000; 3p; In English
Contract(s)/Grant(s): Proj-N00014-98-1-0904
Report No.(s): AD-A372832; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Development of a computational Fluid Dynamic (CFD) based methodology for Autonomous Undersea Vehicle (AUV) Design and performance prediction. Use of the CFD based methodology for a dynamic oceanic circumstance (shallow water).

to develop a set of algorithms for vehicle control and to parametrically explore the range of environmental variables. Development of feature based navigation techniques using side scan sonar data of the sea floor.
DTIC
Underwater Vehicles; Autonomous Navigation; Hydrodynamics

20000032038 Jackson and Tull, Inc., Space and Aeronautics Technology Div., Albuquerque, NM USA
Design and Performance of the Cryogenic Flexible Diode Heat Pipe (CRYOFD) Flight Experiment ***Final Report, 1994-1997***
Thienel, Lee; Lewis, Michael R.; Brennan, Patrick J.; Buchko, Matt; Glaister, Dave; Oct. 1998; 11p; In English
Contract(s)/Grant(s): F29601-94-C-0157; AF Proj. 8809
Report No.(s): AD-A373637; AFRL-VS-PS-TR-1998-1077; Copyright; Avail: Defense Technical Information Center (DTIC)
The first space flight cryogenic flexible diode heat pipes were developed and verified under micro-gravity conditions on the Space Shuttle during STS-94 (July 1997) and the previous, minimum mission STS-83 (March 1997). The heat pipe working fluids were oxygen (with an operating range of 60 to 145 K) and methane (95 - 175 K). The heat pipes were verified as part of the Cryogenic Flexible Diode Beat Pipe (CRYOFD) flight experiment. CRYOFD was the third and fourth flights of the Hitchhiker based Cryogenic Test Bed.
DTIC
Diodes; Heat Pipes; Cryogenics; Design Analysis

20000032040 Academy of Sciences of the Ukraine, Research and Development Center of Fluid Mechanics, Kiev, Ukraine
Optimal Flow Control Based on Excitation of Inherent Coherent Vortices: Fundamental Background ***Final Report***
Yurchenko, N. F.; Aug. 05, 1999; 27p; In English
Contract(s)/Grant(s): F61775-99-W-E075
Report No.(s): AD-A373686; EOARD-SPC-99-4075; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy
This report results from a contract tasking R&DCFM, National Academy of Sciences as follows: The Objectives of the proposed research work are 1) Development of the fundamental ideology of the flow control (according to the Contract F61775-98-WE123) based on the generation and maintenance of a dominant type of a vortical structure (coherent vortices) with chosen values of parameters correlated with the basic flow parameters ”homeopathic treatment” formula; 2) Extension of the proposed boundary-layer control method using specific temperature distribution over a surface (e.g. due to the streamwise heated strips regularly spaced in the transverse direction) to a wider range of practice applications, such as jet-flows attached to a wall of an arbitrary geometry; and 3) Studies of basic mechanisms of the vortex dynamics and essential characteristics of the evolving flow structure under the generation of large scale coherent vortices (velocity profiles, spectral and integral characteristics).
DTIC
Optimal Control; Excitation; Velocity Distribution

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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.

20000029488 Johns Hopkins Univ., Applied Physics Lab., Laurel, MD USA
Miniature X-Ray Bone Densitometer
Charles, Harry K., Jr., Johns Hopkins Univ., USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-108 - B-109; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
The purpose of the Dual Energy X-ray Absorptiometry (DEXA) project is to design, build, and test an advanced X-ray absorptiometry scanner capable of being used to monitor the deleterious effects of weightlessness on the human musculoskeletal system during prolonged spaceflight. The instrument is based on the principles of dual energy x-ray absorptiometry and is designed not only to measure bone, muscle, and fat masses but also to generate structural information about these tissues so that the effects on mechanical integrity may be assessed using biomechanical principles. A skeletal strength assessment could be particularly important for an astronaut embarking on a remote planet where the consequences of a fragility fracture may be catastrophic. The scanner will employ multiple projection images about the long axis of the scanned subject to provide geometric properties in three dimensions, suitable for a three-dimensional structural analysis of the scanned region. The instrument will

employ advanced fabrication techniques to minimize volume and mass (100 kg current target with a long-term goal of 60 kg) of the scanner as appropriate for the space environment, while maintaining the required mechanical stability for high precision measurement. The unit will have the precision required to detect changes in bone mass and geometry as small as 1% and changes in muscle mass as small as 5%. As the system evolves, advanced electronic fabrication technologies such as chip-on-board and multichip modules will be combined with commercial (off-the-shelf) parts to produce a reliable, integrated system which not only minimizes size and weight, but, because of its simplicity, is also cost effective to build and maintain. Additionally, the system is being designed to minimize power consumption. Methods of heat dissipation and mechanical stowage (for the unit when not in use) are being optimized for the space environment.
Author
Bones; Densitometers; Miniaturization; Musculoskeletal System; X Ray Density Measurement; Bone Demineralization; Bioastronautics

20000029489 Massachusetts Inst. of Tech., Cambridge, MA USA
Instrumentation for Non-Invasive Assessment of Cardiovascular Regulation
Cohen, Richard J., Massachusetts Inst. of Tech., USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-110; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

It is critically important to be able to assess alterations in cardiovascular regulation during and after space flight. We propose to develop an instrument for the non-invasive assessment of such alterations that can be used on the ground and potentially during space flight. This instrumentation would be used by the Cardiovascular Alterations Team at multiple sites for the study of the effects of space flight on the cardiovascular system and the evaluation of countermeasures. In particular, the Cardiovascular Alterations Team will use this instrumentation in conjunction with ground-based human bed-rest studies and during application of acute stresses e.g., tilt, lower body negative pressure, and exercise. In future studies, the Cardiovascular Alterations Team anticipates using this instrumentation to study astronauts before and after space flight and ultimately, during space flight. The instrumentation may also be used by the Bone Demineralization/Calcium Metabolism Team, the Neurovestibular Team and the Human Performance Factors, Sleep and Chronobiology Team to measure changes in autonomic nervous function. The instrumentation will be based on a powerful new technology - cardiovascular system identification (CSI) - which has been developed in our laboratory. CSI provides a non-invasive approach for the study of alterations in cardiovascular regulation. This approach involves the analysis of second-to-second fluctuations in physiologic signals such as heart rate and non-invasively measured arterial blood pressure in order to characterize quantitatively the physiologic mechanisms responsible for the couplings between these signals. Through the characterization of multiple physiologic mechanisms, CSI provides a closed-loop model of the cardiovascular regulatory state in an individual subject.
Author
Cardiovascular System; Measuring Instruments; Nonintrusive Measurement; Bioinstrumentation; Bioastronautics; Aerospace Medicine

20000029490 Johns Hopkins Univ., Applied Physics Lab., Laurel, MD USA
Miniature Time-of-Flight Mass Spectrometer
Potember, Richard S., Johns Hopkins Univ., USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-111 - B-113; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Major advances must occur to protect astronauts from prolonged periods in near-zero gravity and high radiation associated with extended space travel. The dangers of living in space must be thoroughly understood and methods developed to reverse those effects that cannot be avoided. Six of the seven research teams established by the National Space Biomedical Research Institute (NSBRI) are studying biomedical factors for prolonged space travel to deliver effective countermeasures. to develop effective countermeasures, each of these teams require identification of and quantitation of complex pharmacological, hormonal, and growth factor compounds (biomarkers) in humans and in experimental animals to develop an in-depth knowledge of the physiological changes associated with space travel. At present, identification of each biomarker requires a separate protocol. Many of these procedures are complicated and the identification of each biomarker requires a separate protocol and associated laboratory equipment. To carry all of this equipment and chemicals on a spacecraft would require a complex clinical laboratory; and it would occupy much of the astronauts time. What is needed is a small, efficient, broadband medical diagnostic instrument to rapidly identify important biomarkers for human space exploration. The Miniature Time-Of- Flight Mass Spectrometer Project in the Technology Development Team is developing a small, high resolution, time-of-flight mass spectrometer (TOFMS) to quantitatively measure biomarkers for human space exploration. Virtues of the JHU/APL TOFMS technologies reside in the promise for a small (less than one cubic ft), lightweight (less than 5 kg), low-power (less than 50 watts), rugged device that can be used continuously with advanced signal processing diagnostics. to date, the JHU/APL program has demonstrated mass

capability from under 100 to beyond 10,000 atomic mass units (amu) in a very small, low power prototype for biological analysis. Further, the electronic nature of the TOFMS output makes it ideal for rapid telemetry to earth for in-depth analysis by ground support teams.
Author
Mass Spectrometers; Time of Flight Spectrometers; Aerospace Medicine; Aerospace Environments; Earth Orbital Environments; Bioinstrumentation

20000029595 Research Inst. of National Defence, Div. of Sensor Technology, Linkoeping, Sweden
Measurement Equipment at the Department of IR Systems
Nelsson, C., Editor; Nilsson, P., Editor; Engquist, I.; Haegaerd, A.; Lindell, R.; Apr. 1999; ISSN 1104-9154; 88p; In English
Report No.(s): PB2000-103096; FOA-R-99-01111-615; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy

At the Department of IR Systems at the Sensor Technology Division different kinds of measurements are performed under various conditions and with many different instrumentations. Most measurement results are published in test reports, including equipment descriptions, calibration procedures and analyzing routines. In order to facilitate the writing procedure, it is desirable to have a reference document where all measurement equipment and related information are presented. Another purpose is to provide a document to be used in contacts with other measurement organizations. The report includes one basic radiometric part, one part that presents the uncertainty methodology used for measurements. The instrument presentations are combined with information about how to calibrate data from each instrument and the uncertainty sources to be considered. As a reference document it will be revised in the future.
NTIS
Infrared Instruments; Infrared Radiation

20000030680 National Optical Astronomy Observatories, Tucson, AZ USA
A Four-Quadrant Error Sensor Which Yields Position and Focus Utilizing an Internal Mirrorlette Array
Vaughnn, David, National Optical Astronomy Observatories, USA; Claver, C. F., National Optical Astronomy Observatories, USA; Richardson, E. Harvey, Victoria Univ., Canada; March 2000; 12p; In English
Report No.(s): NOAO-Preprint-872; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The concept and design for a novel four-quadrant position and focus error sensor are presented. Expected performance and theory of operation of the astigmatic focus sensor are presented. Features include wide field of view, broad wavelength coverage, high efficiency, integral field and pupil stops, and alignment and assembly benefits. A new method for sectioning the field is utilized, an Internal Mirrorlette Array (IMA). The advantages of the IMA are given. This error sensor is implemented in the WIYN Tip-Tilt Module, an add-on imaging instrument for the 3.5 in WIYN telescope at Kitt Peak National Observatory.
Author
Design Analysis; Quadrants; Position Errors; Imaging Techniques; Errors

20000030721 NASA Lewis Research Center, Cleveland, OH USA
Gaussian Beam Intensity Flattener
Griffin, DeVon W., NASA Lewis Research Center, USA; Optical Engineering; July 1999; ISSN 0091-3286; Volume 37, No. 7, pp. 2185-2187; In English
Contract(s)/Grant(s): NAG3-1046; RTOP 010-12-OA; Copyright Waived; Avail: Issuing Activity, Hardcopy

The goal of this investigation was to use commercial elements and extend the correction to a 1/e(sup 2) diameter of 3 mm over long propagation distances. Shafer discussed the use of spherical elements to generate a uniform beam to the 1/e diameter. Derived from text
Lens Design; Lenses; Gradient Index Optics; Geometrical Optics; Optical Properties; Normal Density Functions

20000030736 NASA Langley Research Center, Hampton, VA USA
Substrate Material for Holographic Emulsions Utilizing Fluorinated Polyimide Film
Gierow, Paul A., Inventor, NASA Langley Research Center, USA; Clayton, William R., Inventor, NASA Langley Research Center, USA; St.Clair, Anne K., Inventor, NASA Langley Research Center, USA; Nov. 16, 1999; 4p; In English
Patent Info.: Filed 27 Jun. 1997; NASA-Case-LAR-15447-1; US-Patent-5,986,036; US-Patent-Appl-SN-883851; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A new holographic substrate utilizing flexible. optically transparent fluorinated polyimides. Said substrates have 0 extremely low birefringence which results in a high signal to noise ratio in subsequent holograms. Specific examples of said fluorinated polyimides include 6FDA+APB and 6FDA+4BDAF.
Official Gazette of the U.S. Patent and Trademark Office
Polyimides; Substrates; Transparence; Holography

20000031350 Lowell Observatory, Flagstaff, AZ USA
End-to-End System Test of the Relative Precision and Stability of the Photometric Method for Detecting Earth-Size Extrasolar Planets ***Final Report***
Dunham, Edward W., Lowell Observatory, USA; Feb. 18, 2000; 1p; In English
Contract(s)/Grant(s): NAG2-1328; No Copyright; Avail: Issuing Activity; Abstract Only

We developed the CCD camera system for the laboratory test demonstration and designed the optical system for this test. The camera system was delivered to Ames in April, 1999 with continuing support mostly in the software area as the test progressed. The camera system has been operating successfully since delivery. The optical system performed well during the test. The laboratory demonstration activity is now nearly complete and is considered to be successful by the Technical Advisory Group, which met on 8 February, 2000 at the SETI Institute. A final report for the Technical Advisory Group and NASA Headquarters will be produced in the next few months. This report will be a comprehensive report on all facets of the test including those covered under this grant. A copy will be forwarded, if desired, when it is complete.
Author
End-to-End Data Systems; Photometry; Extrasolar Planets

20000031379 Department of the Navy, Washington, DC USA
Liquid Level Sensor and Detector
Russell, Stephen D., Inventor; Dubbelday, Wadad B., Inventor; Aug. 24, 1999; 11p; In English
Patent Info.: Filed 26 Feb. 97,; US-Patent-Appl-SN-08,806,958; US-Patent-5,942,748
Report No.(s): AD-D019583; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A light emitting photonic structure has a transparent substrate, such as sapphire, supporting a layer of group IV semiconductor material, such as silicon, having at least one porous region from which light is emitted as a response to a stimulus. An example of such a photonic structure is described in U.S. patent application Ser. No. 08/118,900. The photonic structure can be used to assess the presence of various fluids. The photonic structure is disposed to be contacted by the fluid to be sensed should it be present. The light emitting region of the photonic structure is stimulated by an appropriate source, and the light emitted by the photonic source is detected by a detector. The light emitting region of the photonic structure will emit a certain luminescence in air and should the light emitting region be contacted by other fluid or fluids, this luminescence can be affected and the corresponding change in luminescence can be detected thus the presence of these fluids can be sensed. Because the photonic structure has a light emitting region is formed on a transparent substrate, the light emitting region can be both excited and interrogated through the transparent substrate and outside of the presence of the fluid to be sensed. Hence absorption of the excitation radiation used as well as the luminescence emitted by the fluid to be sensed is eliminated.
DTIC
Liquid Levels; Detection; Patents; Patent Applications; Light Emitting Diodes; Semiconductors (Materials)

20000031393 NASA Ames Research Center, Moffett Field, CA USA
Surface Imaging Skin Friction Instrument and Method
Brown, James L., Inventor, NASA Ames Research Center, USA; Naughton, Jonathan W., Inventor, NASA Ames Research Center, USA; Oct. 05, 1999; 20p; In English
Patent Info.: Filed 11 Jun. 1997; NASA-Case-ARC-14189-1; US-Patent-5,963,310; US-Patent-Appl-SN-873352; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A surface imaging skin friction instrument allowing 2D resolution of spatial image by a 2D Hilbert transform and 2D inverse thin-oil film solver, providing an innovation over prior art single point approaches. Incoherent, monochromatic light source can be used. The invention provides accurate, easy to use, economical measurement of larger regions of surface shear stress in a single test.
Author
Imaging Techniques; Skin Friction; Inventions; Patents

20000031605 Department of the Navy, Washington, DC USA

Hybrid Fiber Bragg Grating/Long Period Fiber Grating Sensor for Strain/Temperature Discrimination

Kersey, Alan D., Inventor; Patrick, Heather J., Inventor; Aug. 31, 1999; 8p; In English

Patent Info.: Filed 19 May 97,; US-Patent-Appl-SN-08,858,633; US-Patent-5,945,666

Report No.(s): AD-D019578; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A grating sensor system for simultaneously determining strain and temperature is disclosed, which system comprises: a light source for providing a continuous broadband light; a single mode fiber coupled to the light source; a hybrid fiber grating sensor written into the single mode fiber, the sensor comprised of a long period grating having a first center wavelength and first and second fiber Bragg gratings respectively having second and third center wavelengths for respectively, reflecting light therefrom at about the second and third center wavelengths, with the first center wavelength being between the second and third center wavelengths, the long period grating producing a broadband power loss around its first center wavelength, the first center wavelength shifting with strain and temperature, the sensor measuring the effect of the long period grating wavelength shift on the relative intensities of the light reflected from around the second and third wavelengths; an optical analyzer responsive to the reflected light signals from the hybrid fiber grating sensor for measuring the wavelengths and intensities in the reflected light signals; and a circuit responsive to the measured wavelengths and intensities of light from the optical analyzer for simultaneously calculating the strain and temperature being sensed by the sensor.

DTIC

Bragg Gratings; Bragg Angle; Optical Fibers; Fiber Optics

20000031701 Academia Sinica, Yunnan Observatory, Kunming, China

The Software for Data Acquisition and Control of Photon-Count Type Photoelectric Photometry System

Gu, Sheng-Hong, Academia Sinica, China; Publications of the Yunnan Observatory; 1996; ISSN 1001-7526, No. 4, pp. 81-88; In Chinese; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

In this paper we have reported the research work about the software CMUOPPS for data acquisition and control for the photon-count type photoelectric photometry system made by Yunnan Observatory for Chiang Mai University of Thailand. The function of the hardware port and the plan of handshake between the software and hardware are given, the general property of the software is introduced. The environment and usage of the software are also described. Finally we have shown the running status and result of the software during laboratory test and observation test.

Author

Data Acquisition; Photons; Astronomical Photometry; Electrophotometers

20000031707 Department of the Navy, Washington, DC USA

Video System for Determining a Location of a Body in Flight

Cooper, Guy F., Inventor; Leach, Mark, Inventor; Aug. 17, 1999; 11p; In English; Supersedes US-Patent-Appl-SN-08869932

Patent Info.: Filed 5 Jun. 1997; US-Patent-5,938,545; US-Patent-Appl-SN-08,869,932

Report No.(s): AD-D019541; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A video system, comprising a pair of digital video cameras and a data processing system, which is used to determine the location of a golf ball during flight and the location of the golf ball when its flight is completed. The video cameras are fixedly mounted on a golf cart and boresighted to insure that the field of view for one camera overlaps the field of view for the other camera allowing the golf ball to be tracked after the golf ball is struck by the golfer. Each of the video cameras has an image array comprising a plurality of image sensing elements. As the golf ball travels along its flight path a light image of the golf ball is detected by at least one of the image sensing elements of the image array for each camera during a scan of the camera's image array. Each camera generates a data bit stream indicating the location of the image sensing elements on the image array which sense the golf ball's light image for each scan of the image array. The data bit streams are supplied to the data processing system which then calculates the departure vector, a trajectory path and a circular impact probability (CIP) location for the golf ball when the golf ball lands on the golf course. A monitor provides the golfer with video data indicating the golf ball's circular impact probability location.

DTIC

Patents; Digital Cameras; Data Flow Analysis; Probability Theory

20000031735 Woods Hole Oceanographic Inst., MA USA

Electronic Still Camera Processing and Mosaicking

Howland, Jonathan C.; Lerner, Steven; Dec. 23, 1999; 33p; In English

Contract(s)/Grant(s): N00014-95-1-1237; OCE-9627160

Report No.(s): AD-A372774; WHOI-99-17; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Since 1990, The Deep Submergence Laboratory and Deep Submergence Group of the Woods Hole Oceanographic Institution have been collecting large quantities of digital imagery and creating digital photomosaics of the sea floor. Initially, the digital image collection, processing, and mosaicking processes were all highly specialized

DTIC

Digital Cameras; Electronic Equipment; Mosaics; Oceanography

20000031879 Department of the Navy, Washington, DC USA

Amplified Shear Transducer

Ting, Robert Y., Inventor; Carlson, William B., Inventor; Sep. 07, 1999; 12p; In English; Supersedes US-Patent-Appl-SN-09034771, AD-D019262.

Patent Info.: Filed 2 Mar. 1998; US-Patent-5,948,993; US-Patent-Appl-SN-09,034,771

Report No.(s): AD-D019559; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A 15 mode piezoelectric sensor with mechanical amplification is provided. The sensor consists of two piezoelectric members mounted on an electronically inert, rigid substrate. The two members have an electronically inert amplification device connected between them. When acoustic energy passes through the two members, they develop an electric charge which results in the upper ends of the members moving away from each other. Since the lower ends are anchored in the substrate, this causes a shearing response in the members. The shearing is amplified by the attached amplification device, yielding a strong piezoelectric response. In detection mode, incoming acoustic waves cause a mechanical flex in the attached amplification device. The flex of the amplification device causes a shearing response in the two attached piezoelectric members. This shearing causes a generation of electric charge.

DTIC

Piezoelectricity; Amplification; Electroacoustic Transducers; Piezoelectric Transducers; Patents

20000031886 Department of the Navy, Washington, DC USA

Infrared Optical Fiber Coupler

Schaafsma, David T., Inventor; Sanghera, Jasbinder S., Inventor; Sep. 07, 1999; 12p; In English

Patent Info.: Filed 26 Nov. 97,; US-Patent-Appl-SN-08,980,020; US-Patent-5,949,935

Report No.(s): AD-D019555; No Copyright; Avail: US Patent and Trademark Office, Microfiche

An infrared fiber optic coupler and a method for making an infrared fiber optic coupler are disclosed. The method comprises the steps of: braiding first and second infrared transmitting glass fibers to form first and second arms of the infrared fiber optic coupler; inserting the braided first and second infrared transmitting glass fibers through a furnace; securing the braided glass fibers by two clamping mechanisms on first and second sides of the furnace; purging the furnace of water vapor and oxygen with a steady flow of inert gas through the furnace; allowing infrared light to pass through one of the first and second arms of the coupler; detecting the infrared signals from the first anti second arms of the coupler in first and second infrared detectors; comparing the detected signals to develop a coupling ratio between the first and second arms of the coupler; turning the furnace on to heat the first and second braided glass fibers to the point where the glass fibers begin to darken in color; translating the second clamping mechanism to produce a tautness on the first and second braided glass fibers until the desired coupling ratio has been achieved; turning the furnace off; maintaining tension on the first anti second braided glass fibers until the fibers cool to rigidity; and turning off the gas flow.

DTIC

Fiber Optics; Infrared Detectors; Patents; Infrared Radiation

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.

20000031332 California Univ., Berkeley, CA USA
Novel WDM Device and System Research for Ultra High Capacity Optical Interconnects ***Final Report, 1 Oct. 1996-30 Sep. 1999***
Chang-Hasnain, Connie J.; Willner, Alan E.; Jan. 18, 2000; 20p; In English
Contract(s)/Grant(s): N00014-96-1-1267
Report No.(s): AD-A373497; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Massively parallel interconnection planes can provide an extremely high bandwidth 2-D switching system. by adding wavelength selectivity into the interconnect system, we can significantly increase both the interconnect capacity as well as the dynamically reconfigurable functionality. This program includes a cohesive and comprehensive multi-disciplinary effort at both device and system levels, with novel devices and new systems using these devices. We achieved device-to-systems technology transfer and systems-to-device technology feedback between the two labs. Successful collaborations among students from the two PI's groups were accomplished resulting in many joint publications and patents. The major accomplishments for devices include demonstrations of a tunable VCSEL and tunable detector with the widest continuous tuning range; and demonstration of multi-wavelength VCSEL array and detectors for WDM optical interconnects applications. Detailed characterizations have been performed on packaged devices. Mathematical modeling on tuning-dependent device performance and fabrication/design tolerance was also performed. The accomplishments for systems include demonstration of a multiple-plane WDM interconnection and a highly connected and robust Shuffle Network using a WDM multiple-plane optical interconnection and analysis of its physical limitations concerning: power budget and speed, and the use of integrated electronics for reducing power requirements.

DTIC
Optical Communication; Wavelength Division Multiplexing; Parallel Processing (Computers); Surface Emitting Lasers; Fabrication

20000031597 California Univ., Berkeley, CA USA
Very High Frequency Mode-Stabilized VCSELs for Linear/RF Photonic Applications ***Final Report, 1 May 1996-30 Sep 1999***
Chang-Hasnain, Connie; Lau, Kam; Jan. 18, 2000; 32p; In English
Contract(s)/Grant(s): N00014-96-1-0583
Report No.(s): AD-A373169; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Vertical cavity surface emitting lasers (VCSELs) have emerged as a key optical source in digital and RF photonics systems. Investigation to date has involved VCSELs of "standard" DBR construction. However, incorporation of a controllable saturable absorber inside the lasing cavity results in a wealth of new dynamic characteristics. The focus of this program is on designs and experiments of a novel three contact vertical cavity laser with an intracavity quantum-well. Contrary to all existing laser-absorber integration we achieved an independent control of the gain region and the quantum-well absorber. This allowed the device to be used as an integrated optical source and modulator, or alternatively, providing nonlinearity for self-pulsation and optical feedback. An unprecedentedly wide range of application is made possible with the unique properties and flexibilities. Under this program we graduated 3 PhD students, one post-doctoral researcher and one MS student. The grant also helped to start several new students. We published over 20 publications, filed one patent application and presented 12 invited talks at international conferences. This invention brought forth a completely new class of VCSELs. Many other research organizations have followed our lead and published their new designs and inputs. We believe the impact of this work is a far-reaching one.

DTIC
Laser Cavities; Quantum Wells

20000031613 Research Inst. of National Defence, Div. of Sensor Technology, Linkoeping, Sweden
Laser Beam Steering: An Introductory Study ***Laser Stralstyrning: En Inledande Studie***
Hard, S.; Jacobsson, S.; Loefving, B.; Olin, U.; Rudquist, P.; Jun. 1999; ISSN 1104-9154; 158p; In English
Report No.(s): PB2000-103059; FOA-R-99-01158-408-SE; No Copyright; Avail: CASI; A02, Microfiche; A08, Hardcopy

Laser beam steering is an important feature of almost all military laser systems. Beam steering is in this context defined using a broad description including; beam deflection, pointing, scanning, stabilization etc. The traditional method to perform laser beam steering is to utilize a mirror. However, mirrors suffer from several drawbacks such as e.g. movable parts, mechanical complexity, power requirements and high costs. Recent developments in the field of liquid crystal (LC) technology have shown that laser beam steering can be accomplished with devices based on LC materials. by using the LC device as a spatial light modulator (SLM) to modulate the phase of the laser beam wavefront beam steering can be performed. The purpose of this study was to review the field of laser beam steering, identify important applications for LC beam steering, study technical requirements, analyze the LC beam steering concept and specify a LC beam steering component.
NTIS
Laser Beams; Beam Steering

20000032030 Massachusetts Inst. of Tech., Lincoln Lab., Lexington, MA USA
Mid- and High-Power Passively Q-Switched Microchip Lasers
Zayhowski, John J.; Dill, Colby, III; Cook, Chris; Daneu, John L.; Jan. 1999; 10p; In English
Contract(s)/Grant(s): F19628-95-C-0002
Report No.(s): AD-A373717; MS-13413; ESC*-TR-99-053; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Passively Q-switched Nd:YAG microchip lasers have been developed that produce up to 250 micro-Joule/pulse at 1.064 micrometers, with a pulse duration of 380 ps. The infrared output has been harmonically converted to 532, 355, and 266 nm with high efficiency.
DTIC
Chips (Electronics); High Power Lasers; Neodymium Lasers; Q Switched Lasers; YAG Lasers; Semiconductor Lasers

37
MECHANICAL ENGINEERING

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

20000027692 Department of the Navy, Washington, DC USA
Method and Apparatus for Retaining Wires in a Cylindrical Tube
Mello, Craig S., Inventor, Department of the Navy, USA; Aug. 24, 1999; 7p; In English; Supersedes US-Patent-Appl-SN-954883
Patent Info.: Filed 9 Oct. 1997; US-Patent-Appl-SN-954,883; US-Patent-5,942,712
Report No.(s): AD-D019542; No Copyright; Avail: Defense Technical Information Center (DTIC)

A submarine signal launcher is disclosed for preventing pinched control wires therein. The submarine signal launcher includes a gas generator, an acoustic device countermeasure, a launch tube for housing the gas generator and the countermeasure, and a ram plate positioned between the gas generator and the countermeasure. A status cable is connected to the countermeasure and intermediately threaded through the ram plate and joined to the gas generator. A collapsible tube connected to the ram plate and to the gas generator. The status cable is confined within the collapsible tube. Securing members are formed on opposing ends of the collapsible tube for securing the collapsible tube to the ram plate and the gas generator wherein upon assembly of the gas generator with the ram plate and the countermeasure within the launch tube, the collapsible tube will protect the cable from being pinched between joined ends of the ram plate and the gas generator.
DTIC
Underwater Acoustics; Wire; Cylindrical Bodies; Audio Equipment; Launching

20000029585 National Optical Astronomy Observatories, Tucson, AZ USA
Thermal Control of Classical Astronomical Primary Mirrors
Bohannan, Bruce, National Optical Astronomy Observatories, USA; Pearson, Earl T., National Optical Astronomy Observatories, USA; Hagelbarger, David, National Optical Astronomy Observatories, USA; March 2000; 12p; In English
Report No.(s): NOAO-Preprint-873; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present the conceptual design of a thermal control system for the KPNO Mayall 4-m primary mirror. An electrical current is passed through the reflective coating to match the temperature of the front surface of the mirror to ambient. Cooling of the back with thermo-electric coolers provides a cold reservoir for when the front surface temperature must be decreased. Temperature response of the front surface is estimated from a one-dimensional thermal study: a IC increase can be produced in approx. 1 hour

from 25 watts/sq m of heating and a 1 C drop in approx. 1 hour with a 10 C temperature gradient front-back. Mechanical analysis is used to model optical affects and stress induced by a 10 C temperature gradient through the mirror. Thermal print-through and mechanical stress are found to be negligible. The bending of the mirror by the front-to-back gradient is small and can be removed as a focus shift. Modeling of heat transfer through free air convective simulates the response of a mirror without thermal control. For this case, the time to change the top surface temperature is long because of the mass of the mirror and the relatively poor transfer of energy by convection. For a hot mirror in a 5C cold environment to decrease the temperature by 1 C we estimate approx. 5 hours for the top temperature and approx. 24 hours for the core temperature. Image degradation from radial temperature distributions arising from convective heating or cooling of the mirror by surrounding air can become noticeable (0.05 - 0.1 arcsec FWHM, added in quadrature).
Author
Temperature Control; Mirrors; Design Analysis; Ambient Temperature; Control Systems Design; Convective Heat Transfer; Performance Prediction

20000030714 Department of the Navy, Washington, DC USA
High-Torque Quiet Gear
Moody, Paul E., Inventor; Jul. 27, 1999; 4p; In English; Supersedes US-Patent-Appl-SN-08/502408, AD-D017663.
Patent Info.: Filed 14 Jul. 1995; US-Patent-Appl-SN-502,408; US-Patent-5,927,149
Report No.(s): AD-D019597; No Copyright; Avail: US Patent and Trademark Office, Microfiche
A high-torque quiet gear construction consists of an inner having a plurality of circumferentially spaced arms extending radially outwardly therefrom, and an outer ring member having a plurality of circumferentially spaced teeth extending radially inwardly therefrom. The ring member further includes a plurality of gear formations on an outer surface thereof for intermeshing with other gears. The teeth of the ring member are received in spaced relation in corresponding spaces formed between adjacent arms of the hub. An elastomeric member is received in the space formed between the hub and the ring member to form a resilient correction between the arms of the hub and the teeth of the ring member. The side surfaces of the arms and the teeth extend generally parallel to each other and at least partially overlap in a longitudinal direction. The purpose of this configuration is to place the elastomeric member in compression when torque is applied to the hub. Since elastomeric material is relatively incompressible, the result is low shear loads on the adhesive bonds which hold the elastomeric member to both the hub and outer ring member.
DTIC
Torque; Gears; Gear Teeth; Mechanical Drives; Patents

20000030715 Department of the Navy, Washington, DC USA
Piston and Cylinder Actuated Polymer Mixing Valve
Nedderman, William H., Jr., Inventor; Jul. 20, 1999; 6p; In English; Supersedes US-Patent-Appl-SN-09/062565
Patent Info.: Filed 20 Apr. 1998; US-Patent-Appl-SN-062,565; US-Patent-5,924,453
Report No.(s): AD-D019599; No Copyright; Avail: US Patent and Trademark Office, Microfiche
This patent discloses a valve for introducing polymer into a moving water stream prior to flowing the water stream, with the polymer therein, onto a hull surface of an underwater vehicle. The valve comprises a venturi block having therethrough a venturi passageway for flowing water therethrough, a polymer inlet tube extending through the venturi block and into the venturi passageway for introducing the polymer into the water flowing through the venturi passageway. A shut-off plunger extends through a bore in the venturi block and is axially aligned with the polymer inlet tube, the plunger being reciprocally movable in the bore between a first position in which a head portion of the plunger extends into and seals closed the polymer inlet tube, and a second position in which the head portion of the plunger is spaced from scaling engagement with said polymer inlet tube. A piston and cylinder assembly moves the plunger between the first and second positions.
DTIC
Patents; Pistons; Plungers; Mixers; Mixing; Valves

20000030740 NASA Langley Research Center, Hampton, VA USA
Ferroelectric Fluid Flow Control Valve
Jalink, Antony, Jr., Inventor, NASA Langley Research Center, USA; Hellbaum, Richard F., Inventor, NASA Langley Research Center, USA; Rohrbach, Wayne W., Inventor, NASA Langley Research Center, USA; Oct. 05, 1999; 6p; In English; Provisional application US-Patent-Appl-SN-015969, filed 3 Apr. 1996
Patent Info.: Filed 3 Apr. 1997; NASA-Case-LAR-15407-1; US-Patent-5,961-096; US-Patent-Appl-SN-832260; US-Patent-Appl-SN-015969; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

An active valve is controlled and driven by external electrical actuation of a ferroelectric actuator to provide for improved passage of the fluid during certain time periods and to provide positive closure of the valve during other time periods. The valve provides improved passage in the direction of flow and positive closure in the direction against the flow. The actuator is a dome shaped internally prestressed ferroelectric actuator having a curvature, said dome shaped actuator having a rim and an apex. and a dome height measured from a plane through said rim said apex that varies with an electric voltage applied between an inside and an outside surface of said dome shaped actuator.
Official Gazette of the U.S. Patent and Trademark Office
Control Valves; Ferroelectricity; Fluid Flow

20000031361 SRS Technologies, Huntsville, AL USA
SSME Bearing and Seal Tester Data Compilation, Analysis and Reporting; and Refinement of the Cryogenic Bearing Analysis Mathematical Model ***Final Report, Jan. 1992 - Jan. 2000***
Moore, James, SRS Technologies, USA; Marty, Dave, SRS Technologies, USA; Cody, Joe, SRS Technologies, USA; Jan. 31, 2000; 346p; In English
Contract(s)/Grant(s): NAS8-39379
Report No.(s): TR00-1017; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche
SRS and NASA/MSFC have developed software with unique capabilities to couple bearing kinematic modeling with high fidelity thermal modeling. The core thermomechanical modeling software was developed by SRS and others in the late 1980's and early 1990's under various different contractual efforts. SRS originally developed software that enabled SHABERTH (Shaft Bearing Thermal Model) and SINDA (Systems Improved Numerical Differencing Analyzer) to exchange data and autonomously allowing bearing component temperature effects to propagate into the steady state bearing mechanical model. A separate contract was issued in 1990 to create a personal computer version of the software. At that time SRS performed major improvements to the code. Both SHABERTH and SINDA were independently ported to the PC and compiled. SRS them integrated the two programs into a single program that was named SINSHA. This was a major code improvement.
Author
Mathematical Models; Computer Programs; Kinematics; Thermal Analysis; Seals (Stoppers)

20000031380 Department of the Navy, Washington, DC USA
Braked Linear Nipper
Malthy, John D., Inventor; Fogg, Robert K., Jr, Inventor; Jul. 06, 1999; 12p; In English
Patent Info.: Filed 19 Nov. 97,; US-Patent-Appl-SN-08,974,142; US-Patent-5,919,333
Report No.(s): AD-D019584; No Copyright; Avail: US Patent and Trademark Office, Microfiche
The braked linear nipper of the present invention comprises a belt roller, a belt, and a belt load for applying a squeeze load along a length of a linear material being pulled along the belt by an object onto which the linear material is being wound. The linear material imparts motion to the belt via friction coupled by the squeeze load. A brake coupled to the belt induces a tension in the linear material.
DTIC
Inventions; Patents; Filament Winding; Wire Winding

20000031382 Department of the Navy, Washington, DC USA
Vibration Isolating Flange Assembly
Dubois, Neil J., Inventor; Jul. 13, 1999; 4p; In English; Supersedes US-Patent-Appl-SN-08976133, AD-D018856.
Patent Info.: Filed 29 Sep. 1997; US-Patent-5,921,589; US-Patent-Appl-SN-08,976,133
Report No.(s): AD-D019586; No Copyright; Avail: US Patent and Trademark Office, Microfiche
A vibration isolating flange mount assembly for a pipe has a vibration absorbing gasket and fastener recesses having a vibration dampening material disposed therein to provide a fluid seal between the pipe and a flooded structure and to isolate pipe vibrations.
DTIC
Vibration; Vibration Isolators; Patents

20000031619 NASA Lewis Research Center, Cleveland, OH USA
Dynamic Face Seal Arrangement
Dellacorte, Christopher, Inventor, NASA Lewis Research Center, USA; Dec. 28, 1999; 8p; In English
Patent Info.: Filed 15 Nov. 1996; NASA-Case-LEW-15870-1; US-Patent-6,007,068; US-Patent-Appl-SN-753346; No

Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A radial face seal arrangement is disclosed comprising a stationary seal ring that is spring loaded against a seal seat affixed to a rotating shaft. The radial face seal arrangement further comprises an arrangement that not only allows for preloading of the stationary seal ring relative to the seal seat, but also provides for dampening yielding a dynamic seating response for the radial face seal arrangement. The overall seal system, especially regarding the selection of the material for the stationary seal ring, is designed to operate over a wide temperature range from below ambient up to 900 C.

Author

Seals (Stoppers); Seats; Inventions; Patents

20000031677 Department of the Navy, Washington, DC USA

Brake Actuation Means for a Rotary Pump System

Moody, Paul E., Inventor; Sep. 28, 1999; 7p; In English; Supersedes US-Patent-Appl-SN-08605290

Patent Info.: Filed 17 Jan. 1996; US-Patent-Appl-SN-08,605,290; US-Patent-5,957,668

Report No.(s): AD-D019546; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A rotary pump system includes a rotary pump, a turbine for driving the pump, and a coupling interconnecting a shaft of the turbine and a shaft of the pump. A speed monitoring system determines rotational speed of the pump shaft, is programmed with selected speeds for the pump during operation, and is adapted to send a signal responsive to a difference between the determined speed and the programmed speed. A brake is engageable with the coupling, and a brake valve is adapted to receive the signal and, in response thereto, to operate the brake to conform the speed of the pump to the programmed speed.

DTIC

Patents; Shafts (Machine Elements); Turbines

20000031868 Department of the Navy, Washington, DC USA

Isolation Mounting Device

Hanson, Jeffrey S., Inventor; Sep. 28, 1999; 5p; In English; Supersedes US-Patent-Appl-SN-08645732, AD-D018476.

Patent Info.: Filed 14 May 1996; US-Patent-5,957,427; US-Patent-Appl-SN-08,645,732

Report No.(s): AD-D019562; No Copyright; Avail: US Patent and Trademark Office, Microfiche

An isolation mounting device or assembly is used to mount items or components to a structure in an environment susceptible to vibrational energy, such as a vehicle. The isolation mounting device includes a damping portion, such as a piece of elastomeric damping material, bonded to the surface of the structure to isolate the mounting device and the component from vibrational energy transmitted through the structure. A support base, such as an aluminum block, is bonded to the damping portion to support the component. A fastener engaging portion is fixed to and extends from the support base to engage a fastener that secures the component to the support base. For example, a assembly can be crimped into an aperture formed in the support base so that an internally threaded snap nut post extends through the component and receives a bolt that secures the component to the support base. The component is then easily and removably mounted to the structure without enhancing the transmission of vibration.

DTIC

Damping; Isolation; Vibration Isolators; Patents; Inventions

38
QUALITY ASSURANCE AND RELIABILITY

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

20000028276 Cardiff Univ., School of Engineering, UK

Knowledge Based Failure Diagnostics for Machine Tool Systems

Davies, Alan, Cardiff Univ., UK; International Journal of COMADEM; January 1998; Volume 1, No. 1, pp. 5-11; In English; See also 20000028275; Copyright; Avail: Issuing Activity, Hardcopy

This paper seeks to briefly outline techniques which have been developed in the area of Knowledge Based Condition Monitoring (KBCM) which are specifically designed for, or may be used on, automated machining systems. Although the techniques described herein relate to use on machine tool systems, it is important to note, that some may be suitable for application to other plant and machinery within manufacturing industry.

Author

Diagnosis; Knowledge Based Systems; Machine Tools; Machining; System Failures; Malfunctions; Failure Analysis

20000028278 Shiga Univ., Dept. of Mechanical Systems Engineering, Hikone, Japan

Inspection Intervals for a Condition-Based Maintained System

Okumura, Susumu, Shiga Univ., Japan; International Journal of COMADEM; January 1998; Volume 1, No. 1, pp. 19-23; In English; See also 20000028275; Copyright; Avail: Issuing Activity, Hardcopy

A method for determining the discrete time points of inspection monitoring for a deteriorating single-unit system under condition-based maintenance (CBM) is developed. The transition between the states of a system is described using a symptom-delay-time (SDT) model. The transition time from a normal state to a symptom state and from a symptom state to a failed state are derived from continuous deterioration processes. Failed-dangerous (FD) and failed-safe (FS) probabilities of imperfect inspection are taken into account. A minimization problem of the long-run average cost per unit time is formulated, and the nature and sensitivity of the proposed method are investigated.

Author

Inspection; Maintenance; Probability Distribution Functions; Signs and Symptoms; Logistics Management; Service Life; Quality Control

20000028353 National Inst. of Standards and Technology, Standard Reference Materials Program, Gaithersburg, MD USA

NIST Standard Reference Materials (Trade Name) Program. FY 2000 SRM (Trade Name) Project Plans

Gettings, R. J.; Trahey, N. M.; Dec. 1999; 1p; In English

Report No.(s): PB2000-101536; NISTIR-6451; No Copyright; Avail: CASI; A01, Microfiche; A01, Hardcopy

A Standard Reference Material (SRM) is a certified reference material (CRM) produced in quantity and issued by the National Institute of Standards and Technology (NIST). It is well-characterized for specific physical or chemical properties using state-of-the-art measurement methods and is accompanied by a certificate that reports the results of the characterization and the intended use of the material. SRMs are among the most widely recognized and sought after metrologic products provided by NIST. They are needed by industry, academia, and government to develop methods of analysis, to calibrate measurement systems, to facilitate the exchange of goods, to control measurement assurance programs, to demonstrate measurement competence, and to validate research. Their greatest value is, however, in what they represent as part of the national measurement infrastructure of the USA for which NIST is constitutionally responsible. SRMs provide one of only a few acceptable paths by which traceability to national and international standards of measurement can be achieved and demonstrated.

NTIS

Standards; Project Planning

20000028356 University of Central Florida, Mechanical, Materials and Aerospace Engineering, Orlando, FL USA

A New Real - Time Fault Detection Methodology for Systems Under Test, Phase 1

Johnson, Roger W., University of Central Florida, USA; Jayaram, Sanjay, University of Central Florida, USA; Hull, Richard A., University of Central Florida, USA; Sep. 19, 1998; 44p; In English

Contract(s)/Grant(s): NAS10-0147; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this research is focussed on the identification/demonstration of critical technology innovations that will be applied to various applications viz. Detection of automated machine Health Monitoring (BM, real-time data analysis and control of Systems Under Test (SUT). This new innovation using a High Fidelity Dynamic Model-based Simulation (BFDMS) approach will be used to implement a real-time monitoring, Test and Evaluation (T&E) methodology including the transient behavior of the system under test. The unique element of this process control technique is the use of high fidelity, computer generated dynamic models to replicate the behavior of actual Systems Under Test (SUT). It will provide a dynamic simulation capability that becomes the reference truth model, from which comparisons are made with the actual raw/conditioned data from the test elements.

Derived from text

Real Time Operation; Fault Detection; Simulation; Control Systems Design; Automatic Control; Flight Control; System Identification

20000030735 NASA Langley Research Center, Hampton, VA USA

Method and Apparatus for the Portable Identification of Material Thickness and Defects Using Spatially Controlled Heat Application

Cramer, K. Elliott, Inventor, NASA Langley Research Center, USA; Winfree, William P., Inventor, NASA Langley Research Center, USA; Dec. 14, 1999; 16p; In English

Patent Info.: Filed 4 Mar. 1997; NASA-Case-LAR-15524-1; US-Patent-6,000,844; US-Patent-Appl-SN-810058; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A method and a portable apparatus for the nondestructive identification of defects in structures. The apparatus comprises a heat source and a thermal imager that move at a constant speed past a test surface of a structure. The thermal imager is off set at a predetermined distance from the heat source. The heat source induces a constant surface temperature. The imager follows the heat source and produces a video image of the thermal characteristics of the test surface. Material defects produce deviations from the constant surface temperature that move at the inverse of the constant speed. Thermal noise produces deviations that move at random speed. Computer averaging of the digitized thermal image data with respect to the constant speed minimizes noise and improves the signal of valid defects. The motion of thermographic equipment coupled with the high signal to noise ratio render it suitable for portable, on site analysis.
Official Gazette of the U.S. Patent and Trademark Office
Thickness; Defects; Thermography; Nondestructive Tests

20000030738 NASA Langley Research Center, Hampton, VA USA
Method and Apparatus for Evaluating Multilayer Objects for Imperfections
Heyman, Joseph S., Inventor, NASA Langley Research Center, USA; Abedin, Nurul, Inventor, NASA Langley Research Center, USA; Sun, Kuen J., Inventor, NASA Langley Research Center, USA; Oct. 19, 1999; 10p; In English; Continuation of US-Patent-Appl-SN-571687, filed 13 Dec. 1995, which is a continuation of abandoned US-Patent-Appl-SN-873407, filed 15 Apr. 1992
Patent Info.: Filed 9 Jun. 1997; NASA-Case-LAR-14581-3-SB; US-Patent-5,969,253; US-Patent-Appl-SN-872492; US-Patent-Appl-SN-571687; US-Patent-Appl-SN-873407; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A multilayer object having multiple layers arranged in a stacking direction is evaluated for imperfections such as voids, delaminations and microcracks. First. an acoustic wave is transmitted into the object in the stacking direction via an appropriate transducer/waveguide combination. The wave propagates through the multilayer object and is received by another transducer/waveguide combination preferably located on the same surface as the transmitting combination. The received acoustic wave is correlated with the presence or absence of imperfections by, e.g., generating pulse echo signals indicative of the received acoustic wave. wherein the successive signals form distinct groups over time. The respective peak amplitudes of each group are sampled and curve fit to an exponential curve. wherein a substantial fit of approximately 80-90% indicates an absence of imperfections and a significant deviation indicates the presence of imperfections. Alternatively, the time interval between distinct groups can be measured. wherein equal intervals indicate the absence of imperfections and unequal intervals indicate the presence of imperfections.
Official Gazette of the U.S. Patent and Trademark Office
Defects; Voids; Microcracks; Sound Waves

20000031324 Kaiser Marquardt, Van Nuys, CA USA
What Operation Failure Discovered? Hot-Fire Test *Final Report*
Humphrey, Robert T., Kaiser Marquardt, USA; Jul. 14, 1997; 85p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAS8-40892
Report No.(s): NASA/CR-1999-209749; NAS 1.26:209749; Rept-5285-001(REV.A); No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This document presents a failure analysis report on the hot fire test.
CASI
Failure Analysis; Test Firing; Intake Systems; Injectors

20000031621 NASA Lewis Research Center, Cleveland, OH USA
Video Imaging System Particularly Suited for Dynamic Gear Inspection
Broughton, Howard, Inventor, NASA Lewis Research Center, USA; Nov. 02, 1999; 10p; In English
Patent Info.: Filed 27 Aug. 1997; NASA-Case-LEW-16345-1; US-Patent-5,978,500; US-Patent-Appl-SN-944027; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A digital video imaging system that captures the image of a single tooth of interest of a rotating gear is disclosed. The video imaging system detects the complete rotation of the gear and divide that rotation into discrete time intervals so that each tooth of interest of the gear is precisely determined when it is at a desired location that is illuminated in unison with a digital video camera so as to record a single digital image for each tooth. The digital images are available to provide instantaneous analysis of the tooth of interest, or to be stored and later provide images that yield a history that may be used to predict gear failure, such as gear fatigue.

The imaging system is completely automated by a controlling program so that it may run for several days acquiring images without supervision from the user.
Author
Digital Television; Imaging Techniques; Cameras; Inventions; Patents

39
STRUCTURAL MECHANICS

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

20000030657 NASA Kennedy Space Center, Cocoa Beach, FL USA
Ultrasonic Bolt Gage
Gleman, Stuart M., Inventor, NASA Kennedy Space Center, USA; Rowe, Geoffrey K., Inventor, NASA Kennedy Space Center, USA; Oct. 26, 1999; 14p; In English
Patent Info.: Filed 25 Sep. 1997; NASA-Case-KSC-11929; US-Patent-5,970,798; US-Patent-Appl-SN-936788; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An ultrasonic bolt gage is described which uses a crosscorrelation algorithm to determine a tension applied to a fastener, such as a bolt. The cross-correlation analysis is preferably performed using a processor operating on a series of captured ultrasonic echo waveforms. The ultrasonic bolt gage is further described as using the captured ultrasonic echo waveforms to perform additional modes of analysis, such as feature recognition. Multiple tension data outputs, therefore, can be obtained from a single data acquisition for increased measurement reliability. In addition, one embodiment of the gage has been described as multi-channel, having a multiplexer for performing a tension analysis on one of a plurality of bolts.
Official Gazette of the U.S. Patent and Trademark Office
Ultrasonic Scanners; Bolts; Fasteners; Measuring Instruments

20000031356 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne Australia
Analysis of Responses of a Small Shock Platform Subjected to Underwater Explosions
Burch, I. A.; Mouritz, A. P.; Oct. 1999; 27p; In English
Report No.(s): AD-A373203; DSTO-TR-0891; DODA-AR-011-124; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The dynamic shock loading response of a small floating platform subjected to a series of low level, underwater explosions has been assessed. The platform was designed as a cost-effective and rapid means for facilitating the underwater shock response assessment of naval hull material and shipboard equipment. The test series comprised ten underwater explosions of the same charge size and charge/platform geometry and the shock motions of the platform were measured using accelerometers mounted on the platform bulkheads and deckplate. From the acceleration histories, an average
DTIC
Underwater Explosions; Shock Resistance; Dynamic Response

20000032037 Defence Research Establishment Atlantic, Dartmouth, Nova Scotia Canada
Application of the Finite Element Method to Crack Evaluation of Warships
Smith, M.; Sep. 1999; 48p; In English
Report No.(s): AD-A373628; DREA-TM-1999-154; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The effects of artificial cracks in high stress components of the Halifax class frigate are investigated using two finite element based methodologies currently being considered for use in the Improved Ship Structural Maintenance Management (ISSMM) project. In one method, static stress intensities are determined for each crack configuration using a one percent exceedance wave load in sag. In the other method, the crack growth is predicted for a spectral wave loading corresponding to 100 hours in five meter head seas. A total of fifteen local models in the high stress region of the ship are investigated separately (three crack lengths for each of five locations). No evidence of uncontrolled crack growth is found using either of the two methods for any single crack configuration. The smallest margin of safety (ratio of fracture toughness to predicted stress intensity) is found to he 2.08. Crack growth rates are predicted for a 100 hour voyage in five meter head seas conditions. In this severe sea state the largest average

crack growth rate is found to he 8.55 mm/hour, but at present this result has not been validated. Crack growth predictions can be extended to loadings of different magnitudes using the assumed linearity between wave height and response.
DTIC
Crack Propagation; Finite Element Method; Structural Analysis

20000032046 Washington Univ., Dept. of Aeronautics and Astronautics, Seattle, WA USA
Structural Design Methodology Based on Concepts of Uncertainty ***Final Report, 16 May 1998 - 30 Sep. 1999***
Lin, K. Y., Washington Univ., USA; Du, Jiaji, Washington Univ., USA; Rusk, David, Washington Univ., USA; February 2000; 130p; In English
Contract(s)/Grant(s): NAG1-2055; RTOP 522-31-71-02
Report No.(s): NASA/CR-2000-209847; NAS 1.26:209847; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
In this report, an approach to damage-tolerant aircraft structural design is proposed based on the concept of an equivalent ”Level of Safety” that incorporates past service experience in the design of new structures. The discrete ”Level of Safety” for a single inspection event is defined as the compliment of the probability that a single flaw size larger than the critical flaw size for residual strength of the structure exists, and that the flaw will not be detected. The cumulative ”Level of Safety” for the entire structure is the product of the discrete ”Level of Safety” values for each flaw of each damage type present at each location in the structure. Based on the definition of ”Level of Safety”, a design procedure was identified and demonstrated on a composite sandwich panel for various damage types, with results showing the sensitivity of the structural sizing parameters to the relative safety of the design. The ”Level of Safety” approach has broad potential application to damage-tolerant aircraft structural design with uncertainty.
Author
Structural Design; Aircraft Structures; Probability Theory; Aircraft Safety; Fault Tolerance

42
GEOSCIENCES (GENERAL)

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

20000028410 Geological Survey, Water Resources Div., Columbus, OH USA
Background Hydrogeologic Data, Water Quality, and Aquifer Characteristics, Western Allen County, Ohio
Sheets, R. A.; 1999; 36p; In English
Report No.(s): PB2000-102937; USGS/WRI-99-4146; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy
The purpose of this report is to describe the ground-water hydrology of the proposed well-field area and present the results of aquifer tests that were done at the proposed well field. Data collected during the study include ground-water levels before, during, and after the aquifer tests; chemical analyses of samples collected before the aquifer tests; and flow rates of a nearby spring. Background hydrogeologic data, including water levels and water quality analyses, also are presented. The water-level and flow data are analyzed with respect to pumping rates from the proposed well field.
NTIS
Chemical Analysis; Water Quality; Aquifers; Hydrogeology

20000031319 Geological Survey, Water Resources Div., Ithaca, NY USA
Precipitation-Runoff Model for Part of the Ninemile Creek Watershed Near Camillus, Onondaga County, New York
Zarriello, P. J.; 1999; 72p; In English
Report No.(s): PB2000-103169; USGS-WRI-98-4201; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy
This report describes the HSPF (Hydrologic Simulation Program-FORTRAN) runoff model development and calibration for a 41.7 sq. mi. part of the Ninemile Creek watershed for water years 1989-96. The report also presents two applications of the model: (1) the changes in Ninemile Creek flow that would result from incremental increases in development as (a) open and residential land, and (b) impervious land, and (2) the effects of a hypothetical 147-acre moderate-density residential development, with and without storm water detention, on peak discharge at the Village of Camillus.
NTIS
Watersheds; Precipitation (Meteorology); Hydrology Models

20000031403 Geological Survey, Water Resources Div., Atlanta, GA USA

Hydrogeology and Water Quality of the Upper Floridan Aquifer, Western Albany Area, Georgia

Stewart, L. M.; Warner, D.; Dawson, B. J.; 1999; 52p; In English

Report No.(s): PB2000-103170; USGS/WRI-99-4140; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

The purposes of this report are to (1) describe and compare the local hydrogeologic framework developed for the study area to the regional hydrologic framework developed during previous studies; and (2) describe the areal distribution of water-quality constituents and characteristics in the Upper Floridian aquifer in the western Albany area. The scope of this week includes a well, a spring, and water-filled cave inventory, test drilling of two core holes; examination of cores from the test holes; and installation of six observation wells. Ground-water-level, geophysical, well-construction, hydraulic, ground-water-quality, and environmental tracer and isotope data also were collected and analyzed.

NTIS

Hydrogeology; Water Quality; Aquifers

20000031773 Geological Survey, Water Resources Div., Little Rock, AR USA

Status of Water Levels in Aquifers in the Nacatoch Sand of Southwestern and Northeastern Arkansas and the Tokio Formation of Southwestern Arkansas, 1999

Schrader, T. P.; 1999; 34p; In English

Report No.(s): PB2000-103032; USGS/WRI-99-4208; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Nacatoch Sand and Tokio Formation aquifers in southwestern Arkansas and the Nacatoch Sand aquifer in northeastern Arkansas are a source of water for industrial, public supply, domestic, and agricultural uses. Potentiometric-surface maps were constructed from water-level measurements made in 59 wells completed in the Nacatoch Sand and 45 wells completed in the Tokio Formation from April through May 1999. Long-term hydrographs were prepared for 13 wells in the study area. Changes in water levels in some wells may be associated with changes in withdrawals from the respective aquifers.

NTIS

Aquifers; Sands; Hydrology; Potentiometric Analysis

43
EARTH RESOURCES AND REMOTE SENSING

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

20000031394 NASA Goddard Space Flight Center, Greenbelt, MD USA

Compact Hyperspectral Mapper for Environmental Remote Sensing Applications (CHyMERA) End-of-phase Data Review Package, *8 Feb. 1999 - 7 Feb. 2000*

Janz, Scott J., Maryland Univ. Baltimore County, USA; Hilsenrath, Ernest, NASA Goddard Space Flight Center, USA; Mount, George, Washington State Univ., USA; Heath, Donald, Research Support Instruments, USA; Feb. 15, 2000; 190p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAS5-99141; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

CHYMERA is an Instrument Incubator concept to design, build, and test an instrument that will reduce size, mass, and cost and increase science potential and flexibility for future atmospheric remote sensing missions within the focus of NASA's Earth Science Enterprise (ESE). The primary effort of the development plan will be on high spatial resolution ozone, N02, S02, aerosol, and cloud measurements, but it is hoped that the techniques developed will prove useful for other measurements as well. The core design will involve a high performance, wide field-of-view (FOV) front end telescope which will illuminate a filter/focal plane array (FFPA) package. The use of a non-dispersive optical configuration will reduce size, mass and complexity. The wide FOV optics will permit short duration global coverage (1-2 days) without the need for a scanner.

Author

Remote Sensing; High Resolution; Spatial Resolution; Mapping; Data Acquisition

20000031720 NASA Goddard Space Flight Center, Greenbelt, MD USA

Calculation and Error Analysis of a Digital Elevation Model of Hofsjokull, Iceland from SAR Interferometry

Barton, Jonathan S., General Sciences Corp., USA; Hall, Dorothy K., NASA Goddard Space Flight Center, USA; Sigurosson, Oddur, National Energy Authority, Iceland; Williams, Richard S., Jr., Woods Hole Research Center, USA; Smith, Laurence C.,

California Univ., USA; Garvin, James B., NASA Goddard Space Flight Center, USA; [1999]; 10p; In English; 56th Eastern Snow Conference, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Two ascending European Space Agency (ESA) Earth Resources Satellites (ERS)-1/-2 tandem-mode, synthetic aperture radar (SAR) pairs are used to calculate the surface elevation of Hofsjokull, an ice cap in central Iceland. The motion component of the interferometric phase is calculated using the 30 arc-second resolution USGS GTOPO30 global digital elevation product and one of the ERS tandem pairs. The topography is then derived by subtracting the motion component from the other tandem pair. In order to assess the accuracy of the resultant digital elevation model (DEM), a geodetic airborne laser-altimetry swath is compared with the elevations derived from the interferometry. The DEM is also compared with elevations derived from a digitized topographic map of the ice cap from the University of Iceland Science Institute. Results show that low temporal correlation is a significant problem for the application of interferometry to small, low-elevation ice caps, even over a one-day repeat interval, and especially at the higher elevations. Results also show that an uncompensated error in the phase, ramping from northwest to southeast, present after tying the DEM to ground-control points, has resulted in a systematic error across the DEM.

Author

Error Analysis; Synthetic Aperture Radar; Interferometry; Digital Systems; Iceland; Elevation; ESA Satellites

20000031759 Academia Sinica, Yunnan Observatory, Kunming, China

Visible Area and Coverage Region at the Nanshan Station for the LANDSAT-5 Natural Resources Satellites

Sang, Si-Wu, Academia Sinica, China; Publications of the Yunnan Observatory; 1996; ISSN 1001-7526, No. 4, pp. 55-61; In Chinese; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Orbital characteristics of the land series satellites are introduced in this paper. The visible area and coverage region at Nanshan Station of Urumtsi Astronomical Station are also calculated for landsat-5 satellite.

Author

Natural Satellites; Earth Resources

44
ENERGY PRODUCTION AND CONVERSION

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

20000028293 Houston Univ., TX USA

Conceptual Design of a Martian Power Generating System Utilizing Solar and Wind Energy

Hemmat, Amir, Houston Univ., USA; Nguyen, Chi, Houston Univ., USA; Singh, Bharat, Houston Univ., USA; Wylie, Keir, Houston Univ., USA; Second Annual HEDS-UP Forum; 1999, pp. 131-145; In English; See also 20000028286; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

An all-solar manned mission to Mars must overdesign the photovoltaic array in order to handle dust storm conditions. Wind energy extraction is proven terrestrial technology which can offset the dust storm (and night-time) reductions. A multi-phase project is underway to assess the feasibility and drive the development of wind energy extraction systems for Mars. This project has specifically addressed the design of a Darrieus-style Vertical Axis Wind Turbine (VAWT). The project assumed that wind energy extraction would be a secondary production system to the photovoltaic array. Energy production of 300 kw-hr per Martian day is required for this application. The wind turbine is designed by iteratively stepping through the following tasks: (1) Choose a blade shape; (2) Calculate the aerodynamic loads (primarily to estimate performance); (3) Design the guy cables; (4) Design the blades; (5) Design the tower; and (6) Choose support equipment. The resulting system was estimated at 944 kg. Based on the feasibility assessment mentioned above, a wind speed of 28 m/s or higher must be seen for at least an hour each day. This wind speed is in the realm of possibility as the expected slope winds on Mars will likely be this high or higher. In order to meet this feasibility, the following design trends were seen: low pre-tension guy wires; ultralight blades; and thin lightweight towers. This work also found that if 25 to 35 m/s winds are available for at least one hour during a Martian day (during a dust storm), then wind energy extraction can be expected to be at least as mass-efficient as solar arrays (during a dust storm). Significant issues such as structural dynamics, thermal expansion/contraction, fatigue, blade struts, deployability, and maintainability were not considered at this time.

Author

Extraction; Manned Mars Missions; Mars (Planet); Solar Arrays; Wind Turbines; Windpower Utilization; Windmills (Windpowered Machines); Windpowered Generators; Solar Energy

20000028401 Neptune Sciences, Inc., Reston, VA USA

Research and Development of Automated Battery Chargers/Analyzers ***Final Report***

McCormick, Berry L.; Jan. 31, 2000; 94p; In English

Contract(s)/Grant(s): N00164-96-C-0048

Report No.(s): AD-A373174; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The contract for Research and Development of Automated Battery Chargers/Analyzers was awarded to Neptune Sciences, Inc. to develop advanced battery charging and non-invasive real-time battery diagnostic/analysis techniques. to complete this project Neptune Sciences, Inc. used its considerable in-house expertise in hardware and software development as well as in data collection and analysis. Where additional expertise was required, consultants from industry and academia were retained. Throughout this project, special effort was made to use commercial off-the-shelf (COTS) hardware whenever possible. The goal was to find a better way to determine the state of charge of various types of batteries and create a database for each type and capacity of battery tested. This database could be integrated into a smart charger/analyzer that could determine the remaining life of primary batteries and test secondary batteries and charge them using the most efficient means possible.

DTIC

Battery Chargers; Storage Batteries; Primary Batteries; Software Engineering; Analyzers

20000031717 Department of the Navy, Washington, DC USA

Electrochemical Cell Having a Beryllium Compound Coated Electrode

Szpak, Stanislaw J., Inventor; Boss, Pamela A., Inventor; Jul. 27, 1999; 6p; In English; Supersedes US-Patent-Appl-SN-08/969175

Patent Info.: Filed 12 Nov. 1997; US-Patent-Appl-SN-969,175; US-Patent-5,928,483

Report No.(s): AD-D019524; No Copyright; Avail: US Patent and Trademark Office, Microfiche

An electrochemical cell comprises a container; an electrolyte held within the container, a first electrode positioned in the electrolyte; and a second electrode having a beryllium compound coating. The second electrode is positioned in the electrolyte and generally centered within the first electrode. The second electrode is made of a material selected from the group that includes palladium, AB2 alloys, and AB5 alloys, where A represents magnesium, zirconium, and lanthanum, and B represents vanadium, chromium, manganese, or nickel. The beryllium compound coating is formed by charging the second electrode in the presence of a beryllium salt.

DTIC

Patents; Beryllium Compounds; Electrochemical Cells; Electrolytes

20000031865 NASA Goddard Space Flight Center, Greenbelt, MD USA

The Effect of Cathode Composition on the Thermal Characteristics of Lithium-Ion Cells

Vaidyanathan, Hari, Communications Satellite Corp., USA; Rao, Gopalakrishna M., NASA Goddard Space Flight Center, USA; [1999]; 10p; In English; Lithium-Ion Batteries, 1999, Pennington, NJ, USA; Sponsored by Electrochemical Society, Inc., USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The specific thermal capacity and heat dissipation rate for lithium ion cells containing LiNiO2 and mixed oxide (75%LiCoO2+ 25%LiNiO2) as cathode materials are compared. The experimental measurements were made using a radiative calorimeter consisting of a copper chamber maintained at -168 C by circulating liquid nitrogen and enclosed in a vacuum bell jar. The specific thermal capacity was determined based on warm-up and cool-down transients. The heat dissipation rate was calculated from the values measured for heat radiated and stored, and the resulting values were corrected for conductive heat dissipation through the leads. The specific heat was 1.117 J/ C-g for the LiNiO2 cell and 0.946 J/ C-g for the 75%LiCoO2,25%LiNiO2 cell. Endothermic cooling at the beginning of charge was very apparent for the cell containing 75%LiCoO2,25%LiNiO2 as the cathode. Exothermic heating began at a higher state of charge for the cell with the 75%LiCoO2,25%LiNiO2 cathode compared to the LiNiO2 cathode cell. During discharge, the rate of heat dissipation increased with increase in the discharge current for both types of cells. The maximum heat dissipated at C/5 discharge was 0.065 W and 0.04 W for the LiNiO2 and 75%LiCoO2,25%LiNiO2 cells, respectively, The thermoneutral potential showed variability toward the end of discharge. The plateau region of the curves was used to calculate average thermoneutral potentials of 3.698 V and 3.837 V for the LiNiO2 cell and the 75%LiCoO2,25%LiNiO2 cell, respectively.

Author

Lithium; Metal Ions; Thermal Analysis; Electric Batteries; Cell Cathodes; Composition

20000032029 McMullen (John J.) Associates, Inc., Alexandria, VA USA
Marine Fuel Cell Market Analysis ***Final Report***
Karin, Zvi; Leavitt, N.; Costa, T.; Grijalva, R.; Sep. 1999; 117p; In English
Contract(s)/Grant(s): DTCG39-95-D-E99010; Proj-3310.2
Report No.(s): AD-A373706; R&DC-297-99; USCG-CG-D-01-00; No Copyright; Avail: CASI; A02, Microfiche; A06, Hardcopy

Numerous studies have shown that it is feasible to reform diesel fuel to derive electric power from fuel cells. The improved efficiency, reduced emissions, and other attributes of fuel cells make them an attractive alternative to existing power sources. This study assesses the potential marine demand for fuel cells, and provides incentive for developers to pursue this market. Data on 87,000 worldwide commercial ships and on the US Naval fleet were analyzed to assess the market potential for marine application of two types of fuel cells. in addition, a phone survey of potential users and an international market survey report were used to complement the assessment. independent data assessment by a European consultancy service on the expected marine market penetration of fuel cells yields similar conclusions to those developed here. Marine market penetration is expected to follow the land based stationary and transportation application of the technology. The survey concludes that the majority of new units are concentrated below 2 MW, and amount to about 5000 new units per year. This market can potentially be penetrated by systems made up of multiple 500 kW fuel cell modules. Thus, there is substantial potential demand for fuel cells from the commercial marine sector.
DTIC
Market Research; Molten Carbonate Fuel Cells

45
ENVIRONMENT POLLUTION

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

20000029557 Ohio Univ., Columbus, OH USA
Volcanic Aerosol and Global Atmospheric Effects
Mills, Michael J., Ohio Univ., USA; [1997]; 32p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Humans have long experienced the global atmospheric effects of volcanic eruptions. Benjamin Franklin may have been the first to report the link between volcanism and unusual atmospheric phenomena in 1784, when a strange ”dry fog” and unseasonably cold weather struck Europe. Franklin speculated that the fog was the cause of the cold summer, and that it originated as smoke from either meteorites or volcanic eruptions he knew to have occurred in Iceland over the course of the previous year. The eruption of Krakatoa in 1883, however, produced the first widespread reports of strange atmospheric effects linked to volcanoes. The arrival of global communications ensured that the intense sunsets seen for several years subsequent were attributed to the news of the massive eruption. In retrospect, historical records back through antiquity reveal numerous examples of atmospheric anomalies that correlate with major volcanic eruptions, often in an entirely different part of the world. One of the greatest volcanic disasters to have occurred in human history was the eruption of Santorini, also known as Thera, which occurred circa 1620 BC. The eruption transformed a three-thousand-foot mountain rising from the Aegean Sea into an island rinc, surrounding an enormous crater filled with 2000 feet of seawater. Such was the power and notoriety of the Santorini eruption that some have linked it with the parting of the Red Sea described in the Bible and the demise of the 1400-year-old Minoan civilization on nearby Crete, itself sometimes linked to the fabled lost continent of Atlantis. While serious doubt surrounds such speculation, historical records reveal that the atmospheric effects of the eruption were felt around the globe.
Derived from text
Volcanology; Volcanoes; Aerosols; Atmospheric Effects; Drying; Craters; Cold Weather

20000029597 Harvard School of Public Health, Boston, MA USA
Daily Changes in Oxygen Saturation and Pulse Rate Associated with Particulate Air Pollution and Barometric Pressure ***Topical Report, Sep. 1995 - Dec. 1996***
Dockery, D. W.; Pope, C. A.; Kanner, R. E.; Villegas, G. M.; Schwartz, J.; Jan. 1999; 40p; In English
Report No.(s): PB2000-102977; HEI-RR-83/99; Copyright; Avail: National Technical Information Service (NTIS)

Epidemiology studies have linked fine particulate air pollution with cardiopulmonary mortality and morbidity. Although the underlying biological mechanisms remain largely unknown, results of several studies suggest that respiratory and cardiovascular function may be an important factor. Potential pathways for observed cardiopulmonary mortality might include transient declines in blood oxygenation and/or changes in pulse rate following exposures to particulate air pollution episodes. This study evaluated

potential associations between daily measures of respirable particulate air pollution (PM10) with pulse rate and oxygen saturation of the blood. Pulse rate and oxygen saturation (SpO2) using oximetry were measured daily in 90 elderly subjects living near air pollution monitors during the winter of 1995-96 in Utah Valley. Potential associations of oxygen saturation and pulse rate with barometric pressure were also evaluated. Small but statistically significant positive associations between day-to-day changes in SpO2 and barometric pressure were observed. Pulse rate was inversely associated with barometric pressure. Exposure to particulate pollution was not significantly associated with SpO2 except for male participants 80 years of age or older.
NTIS
Atmospheric Pressure; Pulse Rate; Air Pollution; Physiological Effects; Oxygen

20000029604 Alabama Univ., Tuscaloosa, AL USA
MT3DMS: A Modular Three-Dimensional Multispecies Transport Model for Simulation of Advection, Dispersion, and Chemical Reactions of Contaminants in Groundwater Systems; Documentation and User's Guide ***Final Report***
Zheng, Chunmiao, Alabama Univ., USA; Wang, P. Patrick, Alabama Univ., USA; Dec. 1999; 219p; In English
Report No.(s): AD-A373474; SERDP-99-1; No Copyright; Avail: CASI; A03, Microfiche; A10, Hardcopy

This manual describes the next generation of the modular three-dimensional transport model, MT3D, with significantly expanded capabilities, including the addition of (a) a third-order total-variation-diminishing (TVD) scheme for solving the advection term that is mass conservative but does not introduce excessive numerical dispersion and artificial oscillation, (b) an efficient iterative solver based on generalized conjugate gradient methods and the Lanczos/ORTHOMIN acceleration scheme to remove stability constraints on the transport time-step size, (c) options for accommodating nonequilibrium sorption and dual-domain advection-diffusion mass transport, and (d) a multicomponent program structure that can accommodate add-on reaction packages for modeling general biological and geochemical reactions. MT3DMS can be used to simulate changes in concentrations of miscible contaminants in groundwater considering advection, dispersion, diffusion, and some basic chemical reactions, with various types of boundary conditions and external sources or sinks. The basic chemical reactions included in the model are equilibrium-controlled or rate-limited linear or nonlinear sorption and first-order irreversible or reversible kinetic reactions. MT3DMS can accommodate very general spatial discretization schemes and transport boundary conditions, including: (a) confined, unconfined, or variably confined/unconfined aquifer layers, (b)inclined model layers and variable cell thickness within the same layer, (c) specified concentration or mass flux boundaries, and (d) the solute transport effects of external hydraulic sources and sinks such as wells, drains, rivers, areal recharge, and evapotranspiration.
DTIC
Ground Water; Chemical Reactions; Contaminants; Three Dimensional Models; Water Pollution; User Manuals (Computer Programs); Nonequilibrium Flow; Three Dimensional Flow; Computer Programs; Geochemistry

20000030697 Tetra Tech Environmental Management, Inc., Cincinnati, OH USA
Superfund Innovative Technology Evaluation Program: Technology Profiles. Tenth Edition, Volume 2, Emergency Technology Program
Jul. 1999; 294p; In English
Report No.(s): PB2000-102922; EPA/540/R-99/500B; No Copyright; Avail: National Technical Information Service (NTIS)

The US Environmental Protection Agency's (EPA) Superfund Innovative Technology Evaluation (SITE) includes the 'Emerging Technology Program' which provides funding to developers to continue research efforts from the bench- and pilot-scale levels to promote the development of innovative technologies. EPA has provided technical and financial support to 77 projects in the Emerging Technology Program. of these projects, 66 are completed, 7 are continuing in the program, and 4 have exited the program. Eighteen Emerging Technology Program projects are participating in the Demonstration Program, and 7 of these demonstration projects are completed. The 73 active technologies are divided into the following categories: thermal destruction (9), physical/chemical treatment (38), biological degradation (19), solidification/stabilization (2), and materials handling (5).
NTIS
Environment Protection; Environmental Cleanup; Pollution Control; Waste Treatment

20000031422 Nebraska Univ., Lincoln, NE USA
Ecosystem-Structure Analysis Applied to Indication and study of Earth Astroblemes
Burba, G. G., Jr., Nebraska Univ., USA; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 7-8; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Geological methods are usually used to locate and study astroblemes. These methods are less effective if the astroblemes are covered with glacial deposits, thick soil, or forest. For such astroblemes, it seems possible to use a method based on analysis of

the ecosystem structures. The rivers, geomorphology, soil, and canopy covers jointed into the ecosystem structure. The rivers, geomorphology, soil, and canopy covers jointed into the ecosystem structure have a long memory for the catastrophic changes precipitated by impact explosion. The ecosystem structure of the Zhamanshin astrobleme (Kazakhstan; 48 deg 20 min N 60 deg 58 min E) was studied by this author during a field expedition. The geomorphic data, soil profile, hydrologic pattern, and specie composition were studied at all structural parts of the crater (over 300 sq km). Data described 90 different types of ecosystems and included 250 individual ecosystems. Five maps were created in 1:200,000 scale (surface deposits, geomorphology, soils, vegetation, and drainage net). They were used together with LANDSAT images to produce a final ecosystem map of the astrobleme. Based on the data and the experiences of the Zhamanshin expedition, cameral mapping was conducted on the ecosystem structures of three additional astroblemes. Features of the ecosystem structure of Zhamanshin (13 km in diameter, 0.75 m.y., Kazakhstan) were compared with those of the Popigay astrobleme (100 km diameter, 40 m.y., Siberia), the Araguinha astrobleme (40 km diameter, 250 m.y., Brazil), and the Gasses-Bluff astrobleme (22 Ion diameter, 143 m.y.,AustraIia). All compared astroblemes demonstrated very similar features of the ecosystem structum (in spite of considerable differences in age, climate, prevailing geomorphic processes, and display in relief): (1) The ecosystem structures inside the astroblemes had entirely different patterns compared to the area outside the ejecta blanket; (2) the landscape divisions had a concentric shape inside the astroblemes and an elongated-spotty shape outside the astroblemes; (3) the landscape subdivisions reflected the astroblemes' structures (i.e., central uplift, concentric ring uplifts, slopes, rim, and ejecta blanket); (4) the density of different ecosystems inside the astroblemes was higher than that of the outside areas; (5) in spite of drastic environmental changes during geological history, patterns of soil and vegetation types continued to keep position correspondingly to initial relief of the astroblemes; and (6) the ratio of circularradial to chaotic patterns of the drainage net was 2.5-3x higher within the astroblemes as compared to the outside areas. The above features demonstrate that the ecosystem structure of the astroblemes can exist much longer than relief or any particular natural component. It gives a strong indication that ecosystem-structure examination, along with geological and geophysical methods, can be used as a research tool for the study of astroblemes.
Author
Ecosystems; Geomorphology; Meteorite Craters; Soils; Ejecta; Meteoritic Damage; Topography

20000031456 Academy of Sciences (USSR), Inst. of Geosphere Dynamics, Moscow, USSR
Artificial Ozone-Hole Generation Following a Large Meteoroid Impact into an Oceanic Site
Klumov, B. A., Academy of Sciences (USSR), USSR; Korobov, I. I., Moscow Inst. of Physics and Technology, Russia; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 27; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The impact of a large cosmic body into an oceanic site results in the ejecta of a huge amount of ocean water into the upper atmosphere. We investigated the subsequent evolution of the impact disturbed region in the atmosphere; in addition, we determined time-spatial characteristics and chemical composition of the region. The mass of the impact-produced ejecta is calculated using a strong-explosion model. It is believed this mass would be distributed in the disk-shaped region in the stratosphere at altitudes determined by the floating of a water vapor. The spatial distribution of the water vapor is determined using the calculation of ejecta processes. Subsequent evolution of the region is determined by local atmospheric turbulence and zonal wind distribution. The chemical composition is controlled by photochemical processes. We used a two-dimensional model of the horizontal baroclinic atmosphere based on the Kadomtsev-Petviashvili equations to evaluate the time-space characteristics of the artificial atmospheric spot. to estimate the chemical impact of the ejected water vapor on the stratosphere, we used the advanced stratospheric photochemistry model. Our results show that the impact of a 1-km body creates a long-living disturbance of the ozone concentration in the stratosphere, with a diameter of approximately a few thousand kilometers. A significant (about 50 %) depletion of the ozone concentration occurs in the region; the characteristic lifetime of the disturbance is about a few weeks.
Author
Chemical Composition; Ejecta; Hypervelocity Impact; Meteorite Collisions; Ozone; Ozone Depletion; Stratosphere; Water Vapor

20000031465 Antarctic Inst. of Canada, Edmonton, Alberta Canada
The Mystery of the 536 A.D. Dust Veil Event: Was It a Cometary or Meteoritic Impact?
Mardon, A. A., Antarctic Inst. of Canada, Canada; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 32; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Around 536 A.D., famine, frost, and darkness were recorded in Irish and Chinese historical documents. The purpose of this article is to identify a possible cause (i.e., cometary or meteoritic impact) of the dust veil. The cause of the 536 A.D. atmospheric changes can be examined through dendrochronology, Greenland ice cores, and historical records. First, dendrochronology, the study of the growth of tree rings, is useful. by measuring the growth rate, we can deduce the atmospheric environment of a certain

period in time. We will concentrate on the tree rings of the Irish oak because of the historical evidence. The dendrochronology of the Irish oak shows that the narrowest rings were made in 540-542 A.D. The stunted growth probably was caused by poor temperature and environment. Second, we will examine the Greenland Dve-3 core to determine whether the poor growth was triggered by volcanic activity. The ice core shows an acid layer of volcanic activity. The acid layer from the volcanos in the Greenland core moved from 540 +/- 10 A.D. to 516 +/- 4 A.D., indicating that the hypothesis of volcanic activities on Earth that brought about the famine in 536 A.D. is not substantiated. Third, Irish history records that the ”dust veil” and ”running stars” were shining for 20 days and that there were many earthquakes. Both in China and Byzantium in 530 A.D., it was recorded that Halley’s comet continued to shine for 20 days. In both China and Europe, black clouds, earthquakes, crop failures, frost, and dust veils were recorded. In China, it was recorded that ”dragons” fought in the ponds and damaged trees. The Chinese thought the comet was connected to the fall of the dynasty; the poor political and economic conditions were more likely caused by power struggles between the states, however, and the poor atmospheric environment compounded the problems. Based on historical documents, it can be concluded that a comet or bolide is a possible cause of the dust veil event. The most plausible hypothesis, up until now, has been that a comet or meteorite hit the Earth. This is because the hypothesis of a volcanic dust veil contradicts the evidence of the acid layer in the ice core. However, if a bolide struck the Earth, it would have brought about reduced sunlight, atmospheric changes, failure of crops, plagues, and earthquakes. Thus, we may have a clue to the cause of the atmospheric changes. If a bolide hit the Earth at this point and caused global effects, the threat might be more than expected. The explosion of Thera in the 15th century B.C. caused the downfall of several civilizations, and the same result would be expected from a meteoritic impact of the extent hypothesized above.

Author

Bolides; Cometary Collisions; Dendrochronology; Economic Factors; Dust; Meteorite Collisions; Darkness; Ejecta

20000031481 Lunar and Planetary Inst., Houston, TX USA

Estimates of Climatically Important Gases Released in the Chicxulub Impact Event

Pierazzo, E., Lunar and Planetary Inst., USA; Melosh, H. J., Lunar and Planetary Inst., USA; Kring, D. A., Lunar and Planetary Inst., USA; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 40-41; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The size and the location of the Chicxulub structure, on the Yucatan Peninsula in Mexico and produced by an impact event that occurred about 65 Ma, have driven many speculations that an impact-related abrupt climate change, with catastrophic effects on the biota, resulted in the dramatic extinction event that marks the Cretaceous-Tertiary boundary. We carried out hydrocode calculations of the Chicxulub event using newly developed equations of state of the materials that are believed to play a crucial role in the impact-related extinction hypothesis, namely carbonates (calcite) and evaporites (anhydrite). The outcomes of the simulations rule out CO2 as the major cause for climate changes, as was previously suggested, and indicate that the S-bearing gases and water vapor are the most dangerous impact-related agents for climate change. Impact simulations were carried out using Sandia’s two-dimensional hydrocode CSQIII coupled with the semianalytical equation of state ANEOS. The simulations consist of spherical dunite projectiles (5-10 km in radius) impacting vertically at a speed of 20 km/s. Simulations with 0% and 50% porous projectiles were carried out for each projectile size. According to the scaling law of Schmidt and Housen, the simulations correspond to transient crater diameters ranging from about 60 to 135 km. Actual estimates of the size of the Chicxulub structure vary between 180 and 300 km, corresponding to transient crater sizes in the range of 90-180 km. The target consists of a dunite mantle and an overlying 30-km layer of granitic crust. The local sedimentary sequence of carbonates and evaporites, 2-3 km thick, is modeled by alternating layers of calcite and anhydrite, and the shallow sea that covered the site at the time of the impact is modeled with a 100-m-thick layer of water. ANEOS equations of state for dunite, granite, and water had been previously developed, while ANEOS equations of state for calcite and anhydrite were developed for this work. Finally, the atmosphere is modeled by the ANEOS air equation of state with the terrestrial temperature profile. For each run, the amount of melt and vapor produced in the projectile and various target materials has been calculated. We assumed an average porosity of 20% for the carbonate layer, in agreement with published values between 14% and 26%, and complete saturation with water. We estimated the amount of climatically important species produced in the impact simulations (CO2, S, and water vapor). The estimates, increasing linearly with transient crater size, vary from about 360 to 1700 Gt for CO2 from 300 to 700 Gt for water vapor, and from 60 to 300 Gt for S. A small amount of additional S and water vapor may have been produced from the projectile as well. The CO2 production from our simulations are one to two orders of magnitude lower than previous two-dimensional experiments; the atmospheric injection of such an amount would have produced, at most an increase of 30% in the atmospheric CO2 inventory at the end of the Cretaceous (about 4x present values). Because of the lack of an equation of state for S-rich materials like anhydrite and gypsum, very little work has been done until now to model the amount of S-bearing gases that would be produced by a Chicxulub-sized event. Ivanov et al. give a possible estimate of the amount of S-bearing sediments degassed by the impact. Our simulations produced results not too far from that estimate but consistently higher. Our estimates of the amount of S released in

the impact are several orders of magnitude higher than any known volcanic eruption (e.g., Mt. Pinatubo: 0.01 Gt; Toba: 1 Gt), clearly able to perturb the global climate over timescales of years.
Author
Climate Change; Cretaceous-Tertiary Boundary; Water Vapor; Computerized Simulation; Mathematical Models; Meteoritic Damage; Meteorite Collisions; Sulfur Compounds

20000031482 Geological Survey of Canada, Ottawa, Ontario Canada
Geophysical Signatures of Large Impact Structures
Pilkington, M., Geological Survey of Canada, Canada; Grieve, R. A. F., Geological Survey of Canada, Canada; Hildebrand, A. R., Geological Survey of Canada, Canada; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 41; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Geophysical data are being used increasingly in the identification and characterization of possible and known impact structures, particularly buried structures. Based on the current database of geophysical data over known impact structures, several characteristics of the signature of impact are apparent. The most notable is a circular negative gravity anomaly extending out to the crater rim. This effect is primarily caused by the reduction in the density of the target rocks through fracturing and brecciation. Magnetic anomalies associated with terrestrial impact structures are generally more variable than gravity effects, reflecting the greater variation possible in the magnetic properties of rocks. The dominant effect over structures is a magnetic low or subdued zone. The cause of these lows is not clear. Recent studies of several Canadian structures indicate that all impact lithologies show a reduction in both induced and remanent magnetization levels that is not sufficient to account for the observed magnetic lows. The fractured target rocks also show diminished magnetization levels at depths well below the crater floor, suggesting that the transient stress wave is the likely cause. The primary geophysical signature of impact, consisting of a gravity and magnetic low, can be modified by secondary effects caused by both the preimpact geological structure and postimpact processes such as erosion, burial, and tectonism. At larger complex craters, the gravity low may be modified by the presence of a central gravity high, which is caused by deeper denser crustal material being brought closer to the surface (e.g., Manicouagan, Chicxulub). The magnetic low can be modified by the presence of shorter wavelength, large-amplitude, localized anomalies, which usually occur at or near the center of the structure. Several different sources produce these central magnetic anomalies: magnetic basement rocks may be exposed in the central uplift (e.g., Vredefort, Carswell) and anomalies may correspond to alteration zones within the central uplift area (e.g., Saint Martin), magnetic impact melt rocks, or suevite/ breccias (e.g., Chicxulub, Ries). Erosional effects are most prominent when the structure has been eroded to levels below the original crater floor. In these cases, both gravity and magnetic lows may be removed, and only central anomalies caused by the central uplift remain. Burial will also reduce anomaly amplitudes, possibly to regional anomaly levels, thus obscuring the impact-related signature. Tectonic processes are likely important only for older structures. Deformation may destroy the circularity of the anomalies, while folding and faulting may complicate the preexisting signature (e.g., Sudbury). Regional metamorphism also tends to reduce gravity anomalies by annealing impact-induced porosities. The effect on magnetic anomalies is more difficult to predict because of the greater influence of target-rock composition on magnetic properties . The high level of geological activity on Earth can drastically modify the primary geophysical signature of impact, resulting in geophysical anomalies associated with impact structures having widely varying characteristics. Consequently, the interpretation of geophysical data over a possible structure cannot be done in isolation; rather, it needs to be done in conjunction with the known database and with the consideration of the local geological environment.
Author
Geology; Geophysics; Meteorite Craters; Meteoritic Damage; Projectile Cratering; Magnetic Anomalies

20000031614 University of Southern California, School of Medicine, Los Angeles, CA USA
Statistical Methods for Epidemiologic Studies of the Health Effects of Air Pollution ***Topical Report***
Navidi, W.; Thomas, D.; Langholz, B.; Stram, D.; May 1999; 68p; In English
Contract(s)/Grant(s): RFA 91-1
Report No.(s): PB2000-102980; HEI/RR-86/99; Copyright; Avail: National Technical Information Service (NTIS)

The authors describe two statistical designs that can provide efficient estimates of the health effects of exposure to air pollutants in epidemiologic studies. The authors also evaluate the effects of measurement error in exposure assessment on the accuracy of estimated health effects. The bidirectional case-crossover design is a variant of a method proposed by Maclure. The authors' version of the method takes advantage of the fact that in epidemiologic studies involving environmental exposure, accurate information about past exposure is more readily available, and that levels of exposure are generally unaffected by subject response. It differs from other case-crossover methods in that control information is assessed both before and after failure, thus avoiding confounding due to time trends in exposure. The multilevel analytic design provides a method of combining estimates of health effects made on the individual level with those made at the group level. It is applicable in situations where variations

in exposure within groups are too small to detect health effects, as is often the case in air pollution studies where exposure levels are similar within a geographic community. When the microenvironmental approach is used to estimate, a standard error of 30% in estimating indoor/outdoor ratios can increase the standard error of a relative risk estimate by 50% and introduce bias as well. Similar results hold when exposure is estimated with personal samplers. With the microenvironmental approach, errors in estimating indoor/outdoor ratios have more influence on the accuracy of risk estimation than do errors in estimating the time spent in microenvironments.
NTIS
Statistical Analysis; Epidemiology; Air Pollution; Health

20000031630 Johns Hopkins Univ., School of Public Health, Baltimore, MD USA
Mechanisms of Response to Ozone Exposure: The Role of Mast Cells in Mice ***Topical Report, Mar. 1995 - Mar. 1998***
Kleeberger, S. R.; Longphre, M.; Tankersley, C. G.; Apr. 1999; 48p; In English
Contract(s)/Grant(s): RFPA 93-2
Report No.(s): PB2000-102979; HEI/RR-85/99; Copyright; Avail: National Technical Information Service (NTIS)

Ozone (O3) induces lung inflammation and hypermeability, and epithelial injury in upper and lower airways. The study tested the hypothesis that mast cells mediate airway injury induced by O3 exposure by comparing inflammation, epithelial injury, and ventilatory responses among genetically mast cell-deficient mice; normal, mast cell-sufficient, congenic littermates; and mice that were repleted of mast cells by bone marrow transplantation (BMT). Animals were exposed to 0.26 parts per million O3 or filtered air 8 hours/day, 5 days/week for 1, 3, 14, 30, or 90 days. to evaluate reversibility of exposure-induced lesions, mice from each group were exposed to air or O3 for 90 days and then to filtered air for 35 days. After each exposure and after 35-day recovery, the nasal cavity and lungs were evaluated for inflammation and permeability, and epithelial proliferation. Compared to mast cell-deficient mice, O3 exposure caused greater increases in bronchoalveolar lavage--fluid macrophages, epithelial cells, and polymorphonuclear leukocytes in mast cell-sufficient and BMT mice. Cell responses returned to control levels in all groups of mice after 35-day recovery. In the lung, DNA synthesis increased in O3-exposed normal and BMT mice, but not in mast cell-deficient mice, compared with air controls. Epithelial proliferation remained significantly elevated or even increased in normal and BMT mice after O3 exposure. There were no differences in nasal responses to O3 among the groups up to an exposure of 90 days in duration.
NTIS
Ozone; Physiological Responses; Cells (Biology); Air Pollution

20000031635 Naval Facilities Engineering Service Center, Port Hueneme, CA USA
Closed Loop Aircraft Washrack Wastewater Recycle System ***Final Report, Oct. 1997-Sep. 1998***
Anguiano, G.; Bonner, R.; Torres, T.; Jun. 1999; 90p; In English
Report No.(s): AD-A372864; UDP-2005-ENV; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Aircraft washing operations generated large quantities of wastewater containing free and emulsified oils, and heavy metals in concentrations frequently exceeding local discharge limits. Oil/water separators have proven ineffective as a pretreatment method prior to discharging the wastewater into a sanitary sewer. The Naval Facilities Engineering Service Center developed and field tested a Closed Loop Aircraft Washrack Wastewater Recycle System (CLAWWRS) based on field-proven chemical treatment followed by pre-coat filtration technologies. The system was integrated with an existing washrack at Marine Corps Air Ground Combat Center, Twenty-nine Palms. Analytical results from field tests showed oil and grease removal to less than 15 pprn, and heavy metals consistently reduced under 0.1 ppm. Additionally, the chloride concentration in the recycle water was maintained well below the maximum allowable level of 400 ppm. Typical fresh water consumption of 100,000 gallons during combined armed exercises was reduced to 15,000 gallons. This User Data Package (UDP) provides information and guidance to activities requiring or using a CLAWWRS for their cleaning operations. This UDP addresses issues concerning economic feasibility, site selection and preparation, operator requirements and regulatory requirements. CLAWWRS operating instructions, system drawings, test data, site preparation requirements, economical analysis, and material safety data sheets can be found in the appendices.
DTIC
Aircraft Maintenance; Waste Water; Fresh Water; Flight Operations; Water Consumption; Washing

20000031645 Army Cold Regions Research and Engineering Lab., Hanover, NH USA

Sampling and On-Site Analytical Methods for Volatiles in Soil and Groundwater

Hewitt, Alan D.; Myers, Karen F.; Nov. 1999; 20p; In English

Report No.(s): AD-A373475; OCE-SR-99-16; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Volatile organic compounds (VOCs) are among the most frequently identified contaminants in soil and groundwater samples obtained during the investigation of suspected hazardous waste sites. Because some VOCs and their degradation products are potentially mutagenic, carcinogenic, or teratogenic, their concentrations in these two matrices are key factors in the risk assessment process. Furthermore, when risk-based corrective actions are deemed necessary, the subsequent selection and implementation of the appropriate remediation technologies rely heavily upon the VOC concentrations established during site characterization activities. This report briefly addresses procedures, equipment, and logistics for the collection and timely (less than 48 hr) on-site analysis of VOCs in discrete soil and groundwater samples. The collection, preservation, and preparation procedures presented strive to acquire and maintain analyte concentrations that are representative of the location and medium from which the sample was removed.

DTIC

Ground Water; Organic Compounds; Volatility; Soil Pollution; Contaminants; Degradation

20000031722 NASA Goddard Inst. for Space Studies, New York, NY USA

Regional Sea Level Changes Projected by the NASA/GISS Atmosphere-Ocean Model

Russell, Gary L., NASA Goddard Inst. for Space Studies, USA; Gornitz, Vivien, NASA Goddard Inst. for Space Studies, USA; Miller, James R., NASA Goddard Inst. for Space Studies, USA; [1999]; 48p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Sea level has been rising for the past century, and inhabitants of the Earth's coastal regions will want to understand and predict future sea level changes. In this study we present results from new simulations of the Goddard Institute for Space Studies (GISS) global atmosphere-ocean model from 1950 to 2099. Model results are compared with observed sea level changes during the past 40 years at 17 coastal stations around the world. Using observed levels of greenhouse gases between 1950 and 1990 and a compounded 0.5% annual increase in Co2 after 1990, model projections show that global sea level measured from 1950 will rise by 61 mm in the year 2000, by 212 mm in 2050, and by 408 mm in 2089. By 2089, two thirds of the global sea level rise will be due to thermal expansion and one third will be due to ocean mass changes. The spatial distribution of sea level rise is different than that projected by rigid lid ocean models.

Author

Sea Level; Atmospheric Models; Ocean Models; Computerized Simulation; Annual Variations

20000031771 Lawrence Livermore National Lab., Livermore, CA USA

Evaluation of the Potential Health Effects of the Atmospheric Reaction Products of Polycyclic Aromatic Hydrocarbons ***Topical Report, Jul. 1994 - Jul. 1997***

Grosovsky, A. J.; Sasaki, J. C.; Arey, J.; Eastmond, D. A.; Parks, K. K.; Mar. 1999; 40p; In English

Report No.(s): PB2000-102978; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

The authors utilized human cell assays to evaluate the genotoxicity of naphthalene, phenanthrene, and their atmospheric reaction products 1-nitronaphthalene, 2-nitronaphthalene (2NN), 2-hydroxy-2NN, 2-hydroy-1-nitronaphthalene, 1,4-naphthoquinone, and 2-nitrodibenzopyranone (2NDBP). Simulate atmospheric reaction products of naphthalene were also generated, fractionated, and tested for genotoxic effects using the human B-lymphoblastoid cell line, MCL-5 (which expresses several transfected P450 and epoxide hydrolase genes) and the CREST modified micronucleus assay. 2NN and 2NDBP had greater mutagentic potency than their parent compounds, and both compounds induced significant increases in mutation frequency at tk but not hprt. These findings suggest a mechanistic difference in human cell response as compared with that of bacteria and emphasize the need to consider atmospheric reaction products of polycyclic aromatic hydrocarbons (PAHs) in assessing genotoxicity of air pollutants. The authors also used three related cell lines with multiple (MCL-5), single (AHH-1 1A1), or not (L3) transfected cytochrome P450 genes to investigate whether transfected cytochrome P450 monooygenase activities were required to activate 2NN and 2NDBP to genotoxic species. 2NN and 2NDBP were not activated to genotoxic species through nitroreduction pathways. Mutagenicity induced at the tk locus depended on oxidative metabolism, provided by transfected cytochrome P450 enzymes. The negative response indicates that 2NN and (beta)NA were not activated by similar metabolic pathways and suggests that the genotoxicity of nitro-PAHs in human cells requires oxidative metabolism.

NTIS

Health; Reaction Products; Polycyclic Aromatic Hydrocarbons; Human Reactions

20000031971 Texas A&M Univ., Texas Transportation Inst., College Station, TX USA
Development of Gridded Mobile Source Emissions Estimates for the Houston-Galveston Nonattainment Counties FY2007 in Support of the COAST Project, *1 Sep. - 30 Oct. 1998*
Dresser, G. B.; Bell, C. E.; Dec. 1998; 114p; In English
Report No.(s): PB2000-101733; No Copyright; Avail: National Technical Information Service (NTIS)

This report documents the methodology used to develop the Houston-Galveston Nonattainment Counties gridded mobile source emissions inventories for FY2007. Included in the report are an overview of the emissions estimation methodology and the 24-hour traffic assignments used in the analyses; the methods used to estimate the seasonally adjusted time-of-day vehicle miles of travel and associated operating speeds; the estimation of the emissions rates using the EPA's MOBILE5a Hybrid program; and an outline of the method used to develop the emissions estimates using the MOBILE5a Hybrid emissions rates. These emissions inventories were developed in support of the Coastal Oxidant Assessment of Southeast Texas Project (COAST), a large-scale study of ozone formation being conducted by the Texas Natural Resource Conservation Commission (TNRCC).
NTIS
Estimating; Resources Management

20000032049 Texas A&M Univ., Texas Transportation Inst., College Station, TX USA
Beaumont-Port Arthur Rate of Progress Inventory, *1 Sep. 1998 - 31 Aug. 1999*
Dresser, G. B., Texas A&M Univ., USA; Bell, C. E., Texas A&M Univ., USA; Aug. 1999; 180p; In English
Report No.(s): PB2000-101735; Rept-402011-7; No Copyright; Avail: CASI; A02, Microfiche; A09, Hardcopy

This report documents the mobile source emissions estimation methodology used to develop the on-road mobile source Rate of Progress inventory for the three-county Beaumont-Port Arthur nonattainment area. Included in the report are an overview of the emissions estimation methodology and the 24-hour traffic assignments used in the analyses; the methods used to estimate the seasonally adjusted time-of-day vehicle miles of travel and associated operating speeds; the estimtation of the emissions rates using the EPA's MOBILE5a program; and an outline of the method used to develop the emissions estimates using the emissions rates developed by the MOBILE5a program.
NTIS
Estimating; Traffic; Inventories

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.

20000029580 Colorado Univ., Dept. of Astrophysical, Planetary and Atmospheric Sciences, Boulder, CO USA
Dynamical and Chemical Behavior of the Lower Stratosphere and Interactions with the Troposphere *Final Report*
Salby, Murry L., Colorado Univ., USA; [2000]; 2p; In English
Contract(s)/Grant(s): NAGW-3485; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This research program investigated changes of dynamical and chemical structure of the lower stratosphere and how they are related to elements of the tropospheric general circulation. These considerations were explored in total ozone data from TOMS on board the Nimbus-7 satellite. It was shown that most of the daily variance of total ozone was accounted for by quasi-horizontal transport of ozone along isentropic surfaces in the lower stratosphere. Air descending along theta surfaces experiences compression that increases the local ozone number density and column abundance. Just the reverse is experienced by air ascending along isentropics surfaces. Together, these mechanisms provide an explanation for ozone "mini-hole" phenomenon, which punctuates the circulation of the Southern Hemisphere.
Derived from text
Chemical Composition; Stratosphere; Troposphere

20000030685 Norwegian Seismic Array, Kjeller, Norway
[Seismic Stations: Operation, Maintenance and Research Activities] *Semiannual Report, 1 Apr. - 30 Sep. 1999*
Nov. 1999; 129p; In English
Contract(s)/Grant(s): ARPA ORDER-4138
Report No.(s): AD-A373269; NORSAR-SCIENTIFIC-1-1999/2000; No Copyright; Avail: CASI; A02, Microfiche; A07, Hardcopy

This Semiannual Technical Summary describes the operation, maintenance and research activities at the Norwegian Seismic Array (NORSAR) , the Norwegian Regional Seismic Array (NORES), the Arctic Regional Seismic Array (ARCES) and the Spitsbergen Regional Array for the period 1 April to 30 September 1999. Statistics are also presented for additional seismic stations, which through cooperative agreements with institutions in the host countries provide continuous data to the NORSAR Data processing Center (NDPC). These stations comprise the Finnish Regional Seismic Array (FINES), the German Regional Seismic Array (GERESS), the Hagfors array in Sweden and the regional seismic array in Apatity, Russia. Beginning 1 January 1999, the responsibility for funding the operational activities of the seismic field systems and the Norwegian National Data Center (NDC) has been taken over by the Norwegian Government, with the understanding that the funding of IMS-related activities will gradually be arranged through the CTBTO/PTS. Research activities described in this report, as well as transmission of selected data to the USA NDC, are continuing to be funded by the USA Department of Defense. The NOA Detection Processing system has been operated throughout the period with an average uptime of 99.93%. A total of 2244 seismic events have been reported in the NOA monthly seismic bulletin for April through September 1999. The performance of the continuous alarm system and the data transfer to AFTAC has been satisfactory. Processing of requests for full NOA and regional array data on magnetic tapes has progressed according to established schedules. This Semiannual Report also presents statistics from operation of the Regional Monitoring System (RMS).
DTIC
Seismology; Stations; Signal Processing; Data Acquisition; Earthquakes

20000031409 Lunar and Planetary Inst., Houston, TX USA
Large Meteorite Impacts and Planetary Evolution
Large Meteorite Impacts and Planetary Evolution; 1997; 78p; In English; Large Meteorite Impacts and Planetary Evolution (Sudbury 1997), 1-3 Sep. 1997, Sudbury, Ontario, Canada; Sponsored by Geological Survey of Canada, Canada; See also 20000031410 through 20000031522
Contract(s)/Grant(s): NASw-4574
Report No.(s): LPI-Contrib-992; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
The present volume of abstracts of conference papers discusses topics associated with the role of meteorite impacts on the Earth, the moon, and Titan. Particular attention is given to the description of the impact damage and the description of the actual craters. Attention is also given to the Sudbury structure, and the Chicxulub crater. Mineralogical, geophysical, petrographic, seismic and image data are described and discussed.
CASI
Impact Damage; Meteorite Collisions; Meteoritic Damage; Hypervelocity Impact; Projectile Cratering; Conferences

20000031410 Wien Univ., Inst. of Geochemistry, Austria
BP and Oasis Impact Structures, Libya, and their Relation to Libyan Desert Glass: Petrography, Geochemistry, and Geochronology
Abate, B., Wien Univ., Austria; Koeberl, C., Wien Univ., Austria; Underwood, J. R., Jr., Kansas State Univ., USA; Giegengack, R. F., Pennsylvania Univ., USA; Fisk, E. P., USA; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 1; In English; See also 20000031409; Sponsored in part by the Austrian Academic Exchange Service; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document
The BP impact structure, in Libya at 25 deg 19 min N, 24 deg 20 min E, consists of two eroded and discontinuous rings of hills surrounding a central block, the southern half of which is deeply eroded. The inner ring is about 2 km in diameter and has an average relief of 30 m, while the outer ring has a diameter of about 2.8 km and a maximum relief of about 20 m. Recent space-shuttle radar studies show that the structure probably is 3.2 km in diameter, with the outermost disturbed beds covered by a veneer of sand. Rocks exposed are of the Cretaceous(?) Nubia Group and include quartz sandstone, siltstone, and conglomerate, as well as some shocked materials. The Oasis impact structure, also in Libya (centered at 24 deg 35 min N, 24 deg 24 min E), has a diameter originally determined to be about 11.5 km. The most prominent part of the impact structure, however, is a central ring of hills about 5.1 km in diameter and 100 m high. The diameter of the Oasis, determined from radar images, is estimated to be about 18 km. As at BP, a thin cover of sand obscures the outermost disturbed beds. The structure exposes the same rocks as the BP structure (about 85 km north-northwest of Oasis). As with the BP structure, its age is constrained as younger than the target rocks, which are sandstones of the Nubia Group. Libyan Desert Glass (LDG) is an enigmatic natural glass found in an area of about 6500 square km between sand dunes of the southwestern corner of the Great Sand Sea in western Egypt (near the Libyan border). The glass has a fission track age of 29 Ma and occurs as centimeter- to decimeter-sized irregular, strongly wind-eroded pieces. It seems likely that this glass formed by impact, but no source crater has been determined. Evidence for an impact origin includes the presence of schlieren and partly digested mineral phases, lechatelierite (a high-temperature mineral melt of quartz),

baddeleyite, a high-temperature breakdown product of zircon, and the possible existence of a meteoritic component. However, the proximity of the BP and Oasis structures to the LDG site has led to speculation that one of them might be the LDG source. Our geochemical studies provide the first data for such a comparison. We have studied the petrographical characteristics and geochemical composition of 29 samples from the BP and Oasis sites. Petrographic studies of thin sections of the samples showed that they represent mostly submature, moderately to poorly sorted, medium- to fine-grained quartzite sandstone or quartzitic breccia. Most of the studied samples do not show evidence of shock, but in a few sections some quartz grains with up to three sets of shock-characteristic planar deformation features were found. Major-element compositions of the samples were determined by XRF, while trace-element compositions were determined by neutron-activation analysis. The results available so far indicate a limited range in composition of all analyzed samples. The average LDG composition is very similar to the composition of some of the BP and Oasis sample compositions, indicating a possible relation. We are currently working on Rb-SR and Sm-Nd isotope studies that will provide additional constraints for or against such a relation.
Author
Geochemistry; Petrography; Geochronology; Silica Glass; Meteorite Craters

20000031411 Geological Survey of Ghana, Geological Survey Dept., Accra, Ghana
Overview of Bosumtwi Crater, Ghana
Ahulu, S. T., Geological Survey of Ghana, Ghana; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 1; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Lake Bosumtwi in Ghana occupies a deep circular depression with no outlet. The depression has a raised run with a north-south diameter of 11 km and an east-west diameter of 10 km. The rim is 250-300 m above the surface of the lake, which has a depth of about 80 m. Early studies of the lake, dating back to 1891, appear to have favored a volcanic origin. This view was supported by periodic emissions of sulfurous gas accompanied by the appearance of dead fish, as well as the interpretation of brecciated rocks in the area as volcanic in origin. More recent studies have confirmed that the lake is contained in an impact crater with all the features associated with a structure this size. The crater has steep inner walls, and the presence of a central uplift buried beneath the lake sediments is inferred. Rocks of the impact area are Precambrian and consist of metamorphosed upper- and lower-Birimian sediments and volcanics. Strike is northwest-southeast with steep to vertical dips. Small granite intrusions and a few dikes are also present. The age of the structure has been placed at about 1 Ma. The impacting meteorite has been calculated to have had a diameter of about 300 m and a mass of about 10(exp 8) tons. Evidence suggests that the meteorite had an Fe composition. The Geological Survey of Ghana has instituted a program of studies that includes detailed geological mapping of selected areas of the Bosumtwi structure and ongoing seismic monitoring. The objective of this program is to gain a fuller understanding of the effects of the impact on the surrounding rocks and to explain the sulfurous emissions.
Author
Meteorite Craters; Geochronology; Meteoritic Damage; Earth Surface

20000031412 Geological Survey of Canada, Ottawa, Ontario Canada
Crater-Fill Sequence, Onaping Formation: Petrographic and Geochemical Signature of Regional Hydrothermal Alteration
Ames, D. E., Geological Survey of Canada, Canada; Gibson, H. L., Laurentian Univ. of Sudbury, Canada; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 2; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Comprehensive field and geochronologic evidence indicates that the 140 m-thick Onaping Formation is a hydrothermally altered impact crater-fill sequence with characteristics similar to pyroclastic fall and flow, debris flow, and hydroclastic breccia deposits. A major hydrothermal circulation system in the Sudbury Structure altered the crater-fill deposits around the entire circumference of the exposed structure. Evidence for a regional subseafloor hydrothermal system in the Onaping Formation includes vertically stacked, basin-wide, semiconformable alteration zones in which the rocks have undergone, from base to top, silicification, albitzation, chloritization, carbonatization, and, in the uppermost zone, complex feldspathization. Discontinuous, semiconformable silicified zones up to 440 m thick have been traced for more than 30 km in the North Range at the exposed base of the Onaping Formation. Silicified fragments observed in overlying, relatively unaltered units 200 m above the semiconformable zone suggest at least a partial syndepositional timing. Mineralogically, this zone consists of albite, quartz, actinolite, chlorite, titanite, epidote and minor K-feldspar, calcite, pyroxene, muscovite with traces of chalcopyrite, pyrrhotite, covellite, sphalerite, and magnetite. An earlier phase of K-feldspar alteration is overprinted by albite, quartz, and epidote. Albitization of two types has affected the Sandcherry member (formerly Gray member) strata intensely. Whereas type 1 is a syndepositional pervasive phase, type 2 is fracture-controlled and postdates emplacement of discordant units of ”basal intrusion.” Type 1 albitization is spatially associated with flow-banded aphanitic sills, dikes, and breccia complexes. The least-altered units

have actinolite and chlorite shards in a grayish-green matrix. Upon increasing alteration, the shards acquire variable proportions of actinolite/chlorite, albite, K-feldspar, and quartz. Fluidal fragments are preferentially and pervasively altered. Intense albitization has bleached the units; the matrix and most lithic fragments we partially replaced. Bleached fracture-controlled albitization has an actinolite core and/or an actinolite rim (alteration front). Uranium-lead dating of hydrothermal titanite within the bleached halos constrains the age of the Onaping Formation and defines the timing of the hydrothermal system to 1848 + 3.8/-1.8 Ma. Calcite is pervasive in the upper 1 km of the fragmental sequence except around base metal showings and local zones of lower temperature silicification. In detail, the upper and lower carbonate zone contacts are slightly discordant to stratigraphy. Calcite is ubiquitous in shards and matrix, as rims on lithic fragments, and as fragments with pyrrhotite, chalcopyrite, pyrite, and sphalerite. Calcite pseudomorphs after glass suggest that the calcite is due to syndepositional alteration and is not metamorphic. The upper zone of feldspathization contains low-temperature K-feldspar with minor albite overprinted by celsian, reflecting low-temperature seawater-rock reactions in the shallow sub-seafloor. Emplacement of the Sudbury Igneous Complex and sublayer rocks provided the heat required to initiate fluid circulation in an upper crust that contained a permeable pile of clastic rocks and reactive glass and formed a low-temperature hydrothermal system that produced extensive alteration zones regionally and base-metal mineralization locally.

Author

Geochemistry; Petrography; Mineralogy; Meteorite Craters

20000031413 Geological Survey of Canada, Ottawa, Ontario Canada

Impact-Induced Hydrothermal Base Metal Mineralization, Whitewater Group, Sudbury Structure

Gibson, H. L., Laurentian Univ. of Sudbury, Canada; Ames, D. E., Geological Survey of Canada, Canada; Jonasson, I. R., Geological Survey of Canada, Canada; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 2; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Mineralization within the basin fill of the Sudbury Structure is vastly overshadowed by the huge production and reserves of Cu-Ni-PGE along the outer rim of the Sudbury Igneous Complex. The Onaping Formation is the footwall to Errington and Vermilion massive sulfides that contain proven and probable reserves of 6.4 Mt grading 4.36% Zn, 1.37% Cu, 1.15% Pb, and 55 g/t Ag, as well as minor base metal and Au showings. The sulfide forms multiple lenses; the ”basal pyrite zone” is a replacement of uppermost Onaping Formation, and the Zn-Cu ore bodies lie within a Ca-Mg carbonate exhalite sinter vent complex that grades laterally into Mn-Fe-rich siliceous carbonates of the Vermilion Formation. The hanging wall consists of carbonaceous shales of the Onwatin Formation that contain a 25-sq km plumelike zone enriched in Zn, Cu, Fe, Ba, As, V, and S, reflecting prolonged but diffuse hydrothermal activity. Deposits are mineralogically simple, containing pyrite, chalcopyrite, low-Fe sphalerite (is less than 15 mol percent FeS), galena, marcasite, pyrrhotite, and arsenopyrite. Freibergite and argentite occur at Errington. Gangue is dominated by various generations of Fe-Mg-Mn-Ca carbonates, quartz, barian-feldspar, barian-muscovite, pyrobitumen, trace barian stilpnomelane, and rare Fe-chlorite. Minor Onaping Formation basemetal mineralization occurs as replacement of lapillistone beds and fragments, veins, stringer zones, disseminations, and sulfide fragments situated in silicified zones near the contact with the SIC, near the base of the regional calcite alteration zone (about 1 km from the top), and near the top of the sequence in the upper units. Mineral chemistry and assemblages show that the mineralizing fluids had low a(O2) and a(S2). Organic C (Sigma(sup 13)C(sub PDB) = -30.2) deposited in the ore bodies buffered the hydrothermal system to a low a(O2) Silicification produced a cherry carapace above the sulfides and locally at their base along with Ba-rich feldspars and micas. These, as well as distal-banded Fe-Mn-carbonate and quartz/albite, are interpreted to be the products of diffuse upflow of low temperature fluids. The dominant lower-temperature pyrite-sphalerite assemblages, enriched in Zn, Cd, and Ag are crosscut and replaced by pyrrhotite, chalcopyrite, and high Fe-chlorite, reflecting a later phase of higher temperature upflow. Abundant B throughout the deposit suggests that late hydrothermal reworking was relatively minor and low in temperature. Low-temperature minerals precipitated at an early stage were remobilized to the top of the deposit, and retrograde cooling facilitated low-temperature mineralization in the remaining void spaces. The morphology and composition of regional alteration is similar to that of volcanogenic massive sulfide districts, and the ore assemblages are similar to those of black smokers, except that these deposits formed at 200 C and not 350 C. Extensive (>1 km) hydrothermally altered peperite bodies occur near the top of the Onaping Formation and are restricted to the southwestern part of the basin below the deposits. This implies deepseated, relatively long-lived fracture systems that focused melt and hydrothermal upflow to shallow-water, low-pressure conditions. The complex evolutionary history for the Sudbury impact crater terminated with the major hydrothermal system at 1848 Ma. Low temperature, low a(O2)/a(S2), hydrothermal fluids rising through and altering the ”glassy” fragmental rocks deposited base-metal sulfides due to interaction with carbonates at the base of the regional calcite alteration zone and replacement of the Vermilion Formation.

Hydrothermal fluids responsible for regional alteration and base metals consisted of mixtures of downwelling modified seawater, deep crustal brines, and magmatic fluids.
Author
Metals; Minerals; Geology; Mineralogy; Meteorite Craters; Geochemistry; Petrogenesis; Petrology; Formations

20000031414 Atomic Energy Board, Pretoria, South Africa
Nickel- and Platinum-Group-Element-Enriched Quartz Norite in the Latest Jurassic Morokweng Impact Structure, South Africa
Andreoli, M. A. G., Atomic Energy Board, South Africa; Hart, R. J., Witwatersrand Univ., South Africa; Ashwal, L. D., Rand Afrikaans Univ., South Africa; Tredoux, M., Cape Town Univ., South Africa; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 3; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The 145 +/- 0.8-Ma Morokweng impact structure (diameter about 350 km) is among the largest on Earth. Borehole data show that the center of the structure is represented by a texturally complex, sheet-like igneous body (diameter about 30 km, thickness is greater than = 70 m), interpreted as an impact melt. These igneous rocks consist of a variety of pyroxene-bearing lithologies, the most predominant of which is a homogeneous, medium-grained quartz norite. The melt sheet has a chilled basal contact with underlying basement granitoids, which are intensely affected by shock and thermal metamorphism. In certain places, veins and dikes of heterogeneous and/or finer grained quartz norite, pyroxene-bearing granitoids or pegmatoids and granophyres crosscut the impact melt sheet. Constituent minerals in the impact-melt rocks include plagioclase (An(sub 22-51)), orthopyroxene (En(sub 35)), minor subophitic augite (En(sub 38-42), Wo(sub 40-46)), and granophyric quartz-K-feldspar intergrowths. The opaque minerals occur either as finely disseminated grains (mainly magnetite and ilmenite) or as occasional sulfide-rich blebs and tapering veinlets (up to 3 cm wide) in contact with pyroxenes and quartz. The mineralogy of these veins consists of Ni- and Cu-sulfides (Co-bearing millerite, bornite, chalcopyrite, chalcocite), Ni-rich oxides (bunsenite, Ni-rich ilmenite, trevorite), Ni-rich silicates (liebenbergite, willemseite), and traces of native Pt. The quartz norites are marked by intermediate to acid bulk chemistry (SiO2 = 59-66 wt%, MgO = 2.4-4.9 wt%). They show poorly fractionated REE and striking enrichments in siderophile elements (avg Ir = 3.8 ppb, Au = 9 ppb, Ni = 480 ppm, Cr = 360 ppm). These are equivalent to or above siderophile abundances in mantlederived rocks from the Barberton greenstone belt, possibly indicating an origin as impact-generated crustal melts with appreciable meteoritic contamination. However, Morokweng differs from most other impacts, with the possible exception of Sudbury, in that its impact melts show some degree of differentiation between earlier, medium-grained quartz norite and the crosscutting, finergrained varieties. There is also evidence of enrichment processes affecting the PGE and Au in the millerite-trevorite veins, which show non-chondritic PGE patterns (avg. Os = 9.5 ppm, Ir = 7.8 ppm, Ru = 9.9 ppm, Pt = 2.7 ppm, Pd = 23 ppm, Au = 0.9 ppm). The Ni-rich mineral assemblages are unique, although reminiscent of an enigmatic 3.5-Ga Ni deposit from the Barberton greenstone belt. Additional information is contained in the original.
Derived from text
Impact Melts; Meteorite Craters; Mineralogy; Geochemistry; Ejecta

20000031415 Academy of Sciences (USSR), Vernadsky Inst., Moscow, USSR
Simulating Phase Equilibria and In Situ Differentiation for the Proposed Parental Sudbury Magmas
Ariskin, A. A., Academy of Sciences (USSR), USSR; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 3-4; In English; See also 20000031409
Contract(s)/Grant(s): DFG-436-RUS-17/56/97; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Phase equilibria calculations were performed on the equilibrium crystallization and in situ differentiation for two magma compositions assumed to be parental for the Sudbury Igneous Complex. Preliminary results of the simulations indicate that the observed SIC suite could not be formed during a closed-system fractionation of a single magma body. One of the main problems with petrological interpretation of the Main Mass of the Complex concerns the probable genetic link between, as well as the volumetric relations of, granophyres and norites. to address this problem, we used the COMAGMAT model designed for the calculation of melting-crystallization relationships in basaltic to dacitic systems. This program calculates mineral temperatures and compositions step by step as the total amount of melt is decreased. Modeling Phase Equilibria: We draw attention to the fact that the bulk SIC composition can potentially produce about 70% of a residual melt that contains more than 67% SiO2, whereas the QRN magma can produce only about 30% of such a ”granophyre” liquid. This does not mean, however, that these volumetric proportions between differentiates could result from an in situ magma differentiation process. Simulating In Situ Magma Differentiation: Due to a porosity of natural cumulates, a part of the silica-enriched liquid is known to be trapped as an intercumulus material. to study the effect numerically, we used the INTRUSION routine of COMAGMAT designed for the

simulations of magma differentiation by the convective-cumulative model. This model implies an efficient convective process that is assumed not to prevent eventual settling of crystals suspended in the magma and originated near the roof. COMAGMAT links the phase equilibria and heat-mass transfer calculations into a single algorithm, allowing one to analyze variations of modeled-rock compositions through the vertical section. We performed a set of calculations to account for the settling of Opx, Pl Cpx, and magnetite crystals in a magma body having an initial thickness of 2.5 km, followed by the formation of cumulates containing up to 50% of intercumulus liquid. Even in the case of highly silica enriched SIC composition, the total amount of modeled granophyres does not exceed 25% of the total thickness. In other words, in situ magma differentiation was not able to produce the observed volumetric relations, if the Main Mass indeed represents a complete section of the differentiated SIC magma body. Reasons for the misfit between the calculated succession of crystallizing phases and resulting rock compositions and the geochemical observations are currently being explored. Additional information is contained in the original extended abstract. Author

Crystallization; Minerals; Petrology; Simulation; Models; Magma

20000031416 Muenster Univ., Institut fuer Planetologie, Germany

Investigations of the Green Member of the Onaping Formation, Sudbury Structure, Ontario, Canada

Avermann, M. E., Muenster Univ., Germany; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 4-5; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The polymict, allochthonous breccias on the Onaping Formation occur in the central part of the Sudbury Structure, which is regarded as the possible remnant of a multiring basin. The origin of these breccias has been debated for years. The Onaping breccias were mapped in the North and East Ranges and investigated in detail. In this study an impact origin of the Sudbury Structure is favored. From bottom to top, the 1800 m-thick Onaping Formation is subdivided into Basal, Gray, and Black members. A fourth unit, the Green member, formerly known as the ”chlorite shard horizon”, forms a relatively thin layer between the Gray and Black members. It attains a maximum thickness of 70 m and is thought to be continuous around the structure. The Green member appears as a layer of a rather uniform, strongly chloritized breccia. The contact with the Gray member varies from sharp to gradational. The Green member is characterized by a microcrystalline matrix of small, shocked country rock fragments, melt inclusions, and typical chloritized melt particles, all affected by high temperatures. It is overlain by the clastic matrix breccias of the Black member, which is characterized by a carbonaceous matrix. In its lower unit it shows similarities to the Gray member. The upper Black member displays textural features of reworking and sedimentation under aquatic conditions. The occurrence and texture of the Green member are unique with respect to other known impact structures. Melosh and Peirazzo argue that, in large craters, plume dynamics may need to be considered as part of the late-stage impact processes. The Green member as a melt-rich fall-back layer overlies the suevitic breccias of the Gray member and is interpreted to represent the ”collapsed fire ball horizon” of the Sudbury Structure. As such it originated from early excavation to high atmospheric regimes, condensation of a vapor phase, and deposition with the final fall-back material. If this interpretation is correct, deposition of the Green member terminates the excavation phase. Rainout of melt particles continues into the Black members, but most of the lower Black member represents redeposition and slumping of suevitic material into the central depression (modification process). In summary, the breccias of the Onaping Formation are interpreted as follows: (1) Basal member, clast-rich melt breccia; (2) Gray member, ground surge and fall-back breccias; (3) Green member, melt-rich fall-back; (4) lower Black member, redeposited suevitic breccias; and (5) upper Black member, reworked impact breccias.

Author

Breccia; Topography; Landforms; Meteorite Craters; Geochronology; Geochemistry; Meteoritic Damage; Projectile Cratering

20000031417 NASA Ames Research Center, Moffett Field, CA USA

Extraterrestrial Helium (He@C60) Trapped in Fullerenes in the Sudbury Impact Structure

Becker, L., Scripps Institution of Oceanography, USA; Bada, J. L., Scripps Institution of Oceanography, USA; Poreda, R. J., Rochester Univ., USA; Bunch, T. E., NASA Ames Research Center, USA; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 5; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Fullerenes (C60 and C70) have recently been identified in a shock-produced breccia (Onaping Formation) associated with the 1.85-Ga Sudbury Impact Crater. The presence of parts-per-million levels of fullerenes in this impact structure raises interesting questions about the processes that led to the formation of fullerenes and the potential for delivery of intact organic material to the Earth by a large bolide (e.g., asteroid or comet). Two possible scenarios for the presence of fullerenes in the Sudbury impact deposits are that (1) fullerenes are synthesized within the impact plume from the C contained in the bolide; or (2) fullerenes are already present in the bolide and survived the impact event. The correlation of C and trapped noble gas atoms in meteorites is well established. Primitive meteorites contain several trapped noble gas components that have anomalous isotopic compositions, some

of which may have a presolar origin. Several C-bearing phases, including SiC, graphite, and diamond, have been recognized as carriers of trapped noble gases. It has also been suggested that fullerenes (C60 and C70) might be a carrier of noble gas components in carbonaceous chondrites. Recently, fullerenes have been detected in separate samples in the Allende meteorite. Carbon-60 is large enough to enclose the noble gases He, Ne, Ar, Kr, and Xe, but it is too small to contain diatomic gases such as N2 or triatomic gases such as CO2. Recent experimental work has demonstrated that noble gases of a specific isotopic composition can be introduced into synthetic fullerenes at high temperatures and pressures; these encapsulated gases can then be released by the breaking of one or more C bonds during step-heating under vacuum. These thermal-release patterns for He encapsulated within the C60 molecule (He@C60) are similar to the patterns for acid residues of carbonaceous chondrites, suggesting that fullerenes could be an additional carrier of trapped noble gases in acid residues of meteorites. Analysis and Results: In order to characterize the noble gas compositions of the Sudbury fullerenes, we undertook a systematic study of acid-resistant residues throughout the C-rich layer (Black member) of the Onaping Formation. Samples were demineralized and extracted using standard techniques. The Onaping extracts were analyzed using several techniques, including UV-Vis adsorption, electro spray mass spectrometry, and laser desorption (linear and reflectron) time-of-flight (TOF) mass spectrometry (LDMS). The Sudbury fullerenes were then separated and purified using HPLC coupled with a photo diode array detector. The HPLC extracts containing the purified fullerenes were loaded into a metal tube furnace within a glove box under a N atmosphere in preparation for noble gas analyses. The 3-He and 4-He content of the fullerene extracts was measured using previously reported standard techniques . Discussion: Fullerenes (C60 and C70) in the Sudbury Impact Structure have been found to contain trapped He with a 3-He/4-He ratio greater than 5 x 10(exp -4). The 3-He/4-He ratio exceeds the accepted solar value by more than 30% and is more than 10x higher than the maximum reported mantle value. Terrestrial nuclear reactions or cosmic-my bombardment are not sufficient to generate such a high ratio. The 3-He/4-He ratios in the Sudbury fullerenes are similar to those determined for interplanetary dust particles. The greater-than-solar ratios of 3-He/4-He in the Sudbury fullerenes may indicate a presolar origin, although alternative mechanisms occurring in the ISM to explain these high ratios (e.g., spallation reactions, selective He implantation, etc.) cannot be entirely ruled out. We are currently attempting to isolate enough fullerene material to measure anomalous Ne (or Kr or Xe) contained within the C60 (e.g., the ”pure” 22-Ne component) and thus determine whether the Sudbury fullerenes are indeed presolar in origin.
Author

Breccia; Carbon; Meteorites; Meteoritic Composition; Rare Gases; Meteorite Craters; Fullerenes; Helium

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Summary of Work in Manicouagan Impact Structure

Boivin, L., Mineraux Manic, Inc., Canada; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 5-6; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Manicouagan impact structure is located in the central part of Quebec at 51 degrees 25 minutes north and 68 degrees 45 minutes W. The 100-km circular structure is now unanimously considered to be the product of an hypervelocity-meteorite impact. This structure is located within Precambrian crystalline rocks metamorphosed during the Grenville orogeny at 1 Ga. On a regional scale the rocks are metamorphosed to upper amphibolite and locally granulite facies trending northeast-southwest. This structural fabric is interrupted by the Late Triassic impact structure that created a unique suite of rocks. Physically, the impact structure is a complex crater with a central uplift of anorthositic composition. These anorthosites are surrounded by melt rock rimmed by a margin of latite and suevite. Outcrops are controlled by topography. The main Ethology of the Manicouagan structure is a flat-lying sheet with angular inclusions about 250 m thick and 55 km in diameter. This has been interpreted as impact melt rock. The impact melt is intermediate in composition and shows no major vertical or lateral geochemical variation in the melt rock. The presentation of field data collected by the company will reflect certain interesting observations, and current work should reveal the causes or sources of some of them in time for presentation at the conference. Data will include (1) the shock metamorphism and homogeneous magnetization of all mafic minerals within a certain radius of the impact; (2) the ubiquitous highly magnetic nature of the subaphanitic matrix of the suevite (fall-back breccia) and whether this is due to the Ni-Fe composition of the meteorite that fell there; (3) the condensation of gaseous silica within the suevite unit, producing what has erroneously been identified as amygdular tuff; (4) the presence of postimpact ultramafic magmatism; (5) the presence of sulfide mineralization in two distinct environments; and (6) drill results from a campaign to determine the cause of the 6000-8000 gamma above background anomaly surrounding the point of impact (4 km x 6 km) in the center of the crater.
Author

Geochemistry; Igneous Rocks; Impact Melts; Meteorite Craters; Meteoritic Composition; Mineralogy; Meteoritic Damage; Projectile Cratering

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Composition and Structure of the Chicxulub Crater using Wide-Angle Seismic Velocities

Brittan, J., Imperial Coll. of Science and Technology, UK; Macintyre, H., Imperial Coll. of Science and Technology, UK; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 6; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Chicxulub seismic experiment collected wide-angle seismic data using receivers on the seabed, on land, and on the sea surface. Seismic energy received at wide angles contains precise information about the seismic velocities of the material that the wave traversed and thus can be used to infer the composition of material to great depths within the subsurface. We show seismic velocity images of the shallow (is less than 3 km deep) structure of the crater derived from marine seismic reflection data acquired across the structure. The P-wave velocity structure of the upper parts of the crater is derived from the inversion of wide-angle turning ray data acquired on the streamer during the experiment and during earlier seismic surveys for hydrocarbon exploration. The data show clear velocity images of the peak ring, crater rim, and crater fill. The velocity data allow for a differentiation between the Tertiary fill, the impact ejecta, and the preexisting Cretaceous stratigraphy. Radial asymmetry of the crater structure, which was suggested by gravity profiles in the area, is confirmed by the combined reflection/velocity analysis. The northeast-southwest radial line suggests that the thickened low velocity (and low density) Tertiary fill is responsible for the coincident low in the gravity profile of the crater. The northwest-southeast radial line shows high velocities relatively close to the surface, suggesting high-velocity (and high-density) Cretaceous sediments in this region. Comparisons with the coincident stacked seismic reflection data suggest that the peak ring of the crater is associated with low-velocity material. These low velocities and the position of the peak ring relative to the collapsed margins of the transient crater suggest that it is composed of brecciated material (which may include rocks from the deep basement). In this case the peak ring is thought to represent the outward collapse of a gravitationally unstable central structural uplift. Seismic velocity images of the deeper parts of the crater, and, in particular, the deep central part of the impact structure, have been derived from wide-angle seismic energy collected on about 100 land stations on the Yucatan Peninsula. With further processing, these data will show the extent of the central uplift and the effect of the impact on the lower crust and Moho underneath the center of impact.
Author

Composition (Property); Ejecta; Seismology; Meteorite Craters; Projectile Cratering

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Synthetic Aperture Radar Characteristics of a Glacially Modified Meltsheet, Manicouagan, Quebec

Budkewitsch, P., MIR Teledetection, Canada; Grieve, R., Geological Survey of Canada, Canada; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 6-7; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Major features of large eroded terrestrial impact craters are often difficult to recognize in the field. Satellite images, however, provide synoptic views suitable for the examination of spatially large features such as impact structures. As part of a larger study, RADARSAT data are being utilized, with other SAR, LANDSAT, and other digital (e.g., DEM) data, to characterized large terrestrial impact structures. Here, we focus on the use of RADARSAT data to delineate some of the characteristics of the Manicouagan impact structure. The RADARSAT data were acquired in wide mode beam 2 (W2) centered on the impact structure and covering an area approximately 150 km x 150 km, with a radar incidence angle of 31-39 deg and ground resolution of 27 m. The pervasive tectonic fabric of the Grenvillian target rocks in the area is clearly outlined in the RADARSAT imagery. In addition, many lithotectonic units recognized from regional geological mapping are evident, due to differential erosion along zones of structural or lithological weakness. The preserved impact melt rocks at Manicouagan occur as a flat-lying, up to 250-m-thick, tabular unit on the -50-km-diarneter central island. The central uplifted block of the Grenvillian basement, which penetrates the impact melt sheet, is recognizable in the SAR imagery, contrasting sharply in radar texture with the impact melt rocks. The SAR terrain features visible from the area of the melt-sheet are distinct and are similar to those typical of drumlin fields. to the north of the Manicouagan reservoir, a glacially fluted terrain is recognized with similar features. There are several differences, however, between the appearance of true drumlins and the radar texture of the melt-sheet area: (1) the ”drumlin” features in the melt-sheet area have smaller length-to-width aspect ratios and are topographically higher than the true drumlins composed of drift found to the north; (2) whereas drumlins composed of drift are lenticular, many drumlin-like features on the melt sheet have two lateral terminations (swallow-tail appearance); (3) the north ends of melt-sheet ”drumlins are characterized by high radar backscatter, indicative of exposed bedrock and suggesting that they nucleated on a local erosionally resistant pocket of impact melt rock; and (4) the erosional pattern of the regional Grenville bedrock, as expressed in the RADARSAT data, is profoundly different in character from the erosion of the melt-sheet rocks. While a north-northwest glacial fabric to the outcrop area of the impact melt rocks has been recognized before in optical imagery, this drumlin-like texture is limited to SAR imagery and appears to varying degrees in ERS-1, Seasat and airborne SAR data over Manicouagan. It is not evident in LANDSAT data, and its distribution in

SAR imagery corresponds with the geologic distribution of the melt rocks, suggesting that, at least in this case, RADARSAT data can be used as a lithological mapping tool. We interpret the drumlin-like landforms developed in the melt-sheet area to be the result of significant glacial scouring of relatively compliant, structurally isotropic impact melt rock. In contrast, in the outer zone of the impact structure, SAR data indicate that the glacial erosion preferentially enhances preexisting lithotectonic fabrics or brittle structures of the target bedrock. It is difficult, however, to recognize any radial density change in impact-related fractures in the RADARSAT imagery over the Manicouagan impact structure. The digital topographic data to the west of the central island, however, reveal a number of discontinuous concentric valleys, which are most likely related to structural features of the original impact crater.

Author

Satellite Imagery; Satellite Observation; Meteorite Craters; Ejecta; Meteoritic Damage; Projectile Cratering

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New Potential Sources for Black Onaping Carbon

Bunch, T. E., NASA Ames Research Center, USA; Becker, L., NASA Ames Research Center, USA; Schultz, P. H., Brown Univ., USA; Wolbach, W. S., Illinois Wesleyan Univ., USA; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 7; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

One intriguing and important issue of the Sudbury Structure concerns the source of the relatively large amount of C in the Onaping Formation Black member. This dilemma was recently addressed, and the conclusion was reached that an impactor could not have delivered all of the requisite C. Becker et al. have suggested that much of the C came from the impactor and reported the presence of interstellar He ”caged” inside some fullerenes that may have survived the impact. So, conceivably, the C inventory in the Sudbury Structure comes from both target and impactor materials, although the known target rocks have little C. We discuss here the possibility of two terrestrial sources for at least some of the C: (1) impact evaporation/dissociation of C from carbonate target rocks and (2) the presence of heretofore-unrecognized C-rich (up to 26 wt%) siliceous ”shale,” fragments, which are found in the upper, reworked Black member. Experimental: Hypervelocity impact of a 0.635-diameter Al projectile into dolomite at 5.03 km/s (performed at the Ames Research Center vertical gun range) produced a thin, black layer (= 0.05 mm thick) that partially lined the crater and coated impactor remnants. Scanning electronic microscope (SEM) imagery shows this layer to be spongelike on a submicron scale and Auger spectroscopic analyses yield: 33% C, 22% Mg, 19% 0, and 9% Al (from the projectile). Elemental mapping shows that all of the available 0 is combined with Ca and Mg, Al is not oxidized, and C is in elemental form. Dissociation efficiency of C from CO2 is estimated to be is less than 10% of crater volume. Raman spectroscopy indicates that the C is highly disorganized graphite. Another impact experiment [4] also produced highly disordered graphite from a limestone target (reducing collector), in addition to small amounts of diamond/lonsdaleite/chaoite (oxidizing collector). These experiments confirm the reduction of C from carbonates in impact vapor plumes. Observational: SEM observations and microprobe analyses of small, black shalelike inclusions in the upper Black Onaping indicate high C contents (7-26 wt% avg. = 16%). They contain mostly quartz and carbonaceous matter with small amounts of altered K-feldspar, clays, Fe oxide, and a sulfide. No evidence of shock is seen in quartz, and overall characteristics indicate a natural, lightly metamorphosed carbonaceous shale or mudstone that probably existed as a preimpact rock in the target region and distal fragments washed in during early crater filling. Fragments range in size from tens of microns to cm and increase in abundance in the upper Black toward the Onwatin contact, although their distribution is highly irregular. This increase corresponds to an increase in ”organic” C with increasingly negative delta-13 C values and S, together with a decrease in fullerene abundance. In addition, we have found soot in acid-demineralized residues of the Onwatin but not in the Onaping samples. These data could be consistent with impact plume and atmospheric chemical processes, with possible diageneric ovedays. We are analyzing carbonaceous fractions of the Onaping and Onwatin to determine diagnostic C isotopic signatures Analyses by Whitehead et al. on bulk samples revealed no definitive source or processes, although delta-13 C values for ”organic” C overlapped those for some meteorites. Discussion: If impact evaporation of Sudbury target carbonates did occur, then where are the carbonates? Distal carbonate (limestone/dolostone) exposures of the Espanola Formation (Huronian Supergroup) are generally thin-bedded, although remnants that partially encompass the Sudbury Crater are variable in thickness and may locally reach 250 m . If a carbonate thickness of 100-200 in existed at the target site, then copious amounts of C could have been reduced by impact processing of carbonates and also C-shale, depending on the efficiency of the processing and the amount of postimpact oxidation. Conclusion: The Sudbury crater offers a unique opportunity to study preserved characteristics of immediate carbonaceous fallback matter and particles of short-term residency in the impact plume as well as dust/aerosols from postimpact atmospheric processing.

Author

Carbon; Impactors; Meteorite Craters; Meteorites; Impact Damage; Carbonates

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Sedimentary Interbeds of the Rooiberg Group at the Loskopdam Section, Bushveld Complex, South Africa

Caress, M. E., New Mexico Univ., USA; Elston, W. E., New Mexico Univ., USA; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 8; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The question of whether the Rooiberg Group, the basal unit of the Bushveld Complex, represents a catastrophic event or a gradual transition from normal Pretoria Group sedimentation to Bushveld magmatism is central to identification of the Bushveld Complex as a multiple-impact site or the result of endogenic processes of an unprecedented scale. The Loskop Dam section is thought to represent ponding within an annular basin of initial ejecta and later outflow from the volcanic or psuedovolcanic system that resulted from a catastrophe. The Rooiberg Group in the Loskop Dam area consists of a 3.5-km-thick succession of nine ”felsite” units. In units 1-8 sedimentary interbeds are from a few to 60 m. A 250-m succession of pyroclastic and sedimentary beds occurs between units 8 and 9. The interbeds were traced along strike for 10 km. While some interbeds separate felsite units, others occur within them. Forty six samples were collected from sedimentary interbeds from unit 1 through the transition from units 7 to 8. They record progressive changes that correlate with chemical and textural changes in associated felsites and indicate that emplacement of the Rooiberg Group can be divided into three stages: 1. An initial Bushveld catastrophe in a shallow subaqueous environment resulted in a multiring basin. The basal hot debris flow preserved in the Stavoren ”fragment” and the Dullstroom paleochannel are not exposed at Loskop Darn, but a 30-m section of quartzite with quartz paramorphs after tridymite is present near the middle of unit 1. Other sedimentary interbeds in units 1 and 2 (Upper Dullstroom and Lower Damwal Formation) are interpreted as rapidly eroded material from uplifted rings of the pre-Bushveld Pretoria Group, resulting in sandstone and massive breccia. Few, if any, felsite components other than ashfall material are present in most beds. The sandstones are graywackes with subrounded to subangular quartz grains of silt to coarse sand, clay, sedimentary lithic clasts, and minor plagioclase and opaque minerals. Derivation of quartz grains and lithics of the interbeds from the Pretoria Group is indicated by chemical similarities between the deposits and the scarcity of phenocrystic quartz in the felsite. Most breccias consist of matrix-supported sedimentary clasts of Pretoria Group rocks in a graywacke matrix. Two breccia zones, however-one within unit I and the other between units 2 and 3--consist mainly of felsite clasts in a graywacke matrix and are interpreted as locally derived. The 1400-m Loskop Dam section of units 1 and 2 seems to record repeated effusions of diverse superheated melts and hot-debris flows from a central basin into a ring syncline. Eruptions may have been triggered by influxes of resurgent waters carrying breccia of local derivation (felsite) and sand from more distant sources. 2) Units 34 (the upper part of the Damwal Formation) record further effusions of melts of more restricted composition during a period of magmatic equilibration and structural adjustment. The sedimentary interbeds are composed primarily of moderately well sorted orthoquartzites, which change upward from a massive bed between units 3 and 4 to increasingly bedded sandstones with both planar and cross bedding, interbedded with minor breccia beds containing sedimentary clasts. 3) Units 7-9 reflect residual activity, as melts equilibrated with crustal rocks. Outflow deposits of meltrocks increasingly resemble conventional lavas and pyroclastic rocks in texture and chemical compositions and are interlayered with pyroclastic fall beds and sedimentary beds, which include erosional products of both felsites and the Pretoria Group. These rocks constitute the Kwaggasnek and Schrikkloof Formations.

Author

Ejecta; Volcanology; Topography; Geomorphology; Landforms; Earth Crust

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The Chicxulub Seismic Experiment

Morgan, J., Imperial Coll. of Science and Technology, UK; Warner, M., Imperial Coll. of Science and Technology, UK; Brittan, J., Imperial Coll. of Science and Technology, UK; Macintyre, H., Imperial Coll. of Science and Technology, UK; Synder, D., British Institutions’ Reflection Profiling Syndicate, UK; Hobbs, R., British Institutions’ Reflection Profiling Syndicate, UK; Suarez, G., Universidad Nacional Autonoma de Mexico, Mexico; Marin, L., Universidad Nacional Autonoma de Mexico, Mexico; Trejo, A., Universidad Nacional Autonoma de Mexico, Mexico; Buffler, R., Texas Univ., USA; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 9; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

On the basis of an anomalous clay layer observed at Cretaceous Tertiary boundary sites, Alvarez et al. proposed that there had been a large impact at the end of the Cretaceous 65 Ma. The Chicxulub crater in Mexico, which is the largest-known Phanerozoic impact structure, is now widely accepted as the site of this event. The Chicxulub impact occurred on a gradually subsiding carbonate platform; the crater has been slowly buried beneath Tertiary sediments and remains relatively pristine and undeformed. Its location below the Earth’s surface and partly onshore/offshore makes Chicxulub an ideal target for seismic investigation; many shots fired offshore were recorded on a dense array of offshore and onshore receivers, providing high density data coverage at relatively low cost. We acquired about 650 km of whole crystal marine seismic reflection profile. The 13,000

airgun shots fired to generate these data were recorded simultaneously at wide angle on 91 land and 34 offshore stations. In addition, we recorded local, regional, and teleseismic activity at 20 of the lend stations for several months. These seismic data, together with existing gravity, magnetic and well control, provide a comprehensive image of the structure of the crater in three dimensions. We present intermediate stacks of the new reflection data, which will be fully processed by fall 1997, and first results from the wide-angle and earthquake data, which will be fully processed by fall 1998. Additional information is contained in the original (figure).
Author
Meteorite Craters; Impact Damage; Seismology; Projectile Cratering; Cretaceous-Tertiary Boundary

20000031425 Texas Univ., Institute for Geophysics, Austin, TX USA
Structure of the Chicxulub Impact Crater From Wide-Angle Ocean-Bottom Seismograph Data
Christeson, G. L., Texas Univ., USA; Nakamura, Y., Texas Univ., USA; Buffler, R. T., Texas Univ., USA; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 9; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

During September-October 1996, BIRPS shot three seismic lines across the offshore portion of the Chicxulub impact crater. As part of a larger campaign with collaborators from the UK, Mexico, Canada, and the USA, the University of Texas Institute for Geophysics placed 34 ocean-bottom seismograph (OBS) receivers at 10-20 km spacing along two of the three lines; 32 of the instruments recorded high-quality wide-angle seismic data. These data are being used to model the velocity structure and map deformation of the crust-mantle boundary beneath the Chicxulub impact crater. Seismic velocities can be used to infer compositions and structure of the crater, to properly position the seismic reflection data in depth, and to aid in the interpretation of gravity and magnetic modeling. All receivers recorded a high-amplitude PmP arrival; the PmP event is formed from energy that reflects off the Moho at large angles of incidence. Normal-incidence Moho reflections are also of high amplitude locally. Along Line A, located close to and parallel to the coastline, the PmP event is delayed on receivers located within the crater and can be modeled by crustal thickening beneath the crater. This is in agreement with the seismic reflection data, which has the Moho at a later two-way travel time beneath the crater. Another major feature of the preliminary velocity model is a thickening by as much as 2 km of material with velocities less than 6 km/s beneath the crater. This correlates in the reflection data with the downdropping of Mesozoic blocks and a thickening of ejecta-breccia material toward the center of the crater. Preliminary modeling indicates asymmetry in the crater structure along Line A; this asymmetry will be refined with further analysis.
Author
Deformation; Ejecta; Meteorite Craters; Impact Damage; Models; Seismology; Meteoritic Damage

20000031426 Museum fuer Naturkunde, Berlin, Germany
The Chicxulub Impact Structure and its Proximal Ejecta
Claeys, P., Museum fuer Naturkunde, Germany; Deutsch, A., Muenster Univ., Germany; Langeshorst, F., Bayerisches Geoinstitut, Germany; Heuschkel S., Museum fuer Naturkunde, Germany; Dissman, B., Muenster Univ., Germany; Stoeffler, D., Museum fuer Naturkunde, Germany; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 9-10; In English; See also 20000031409 Contract(s)/Grant(s): DFG-Cl147/2-1; DFG-De401/13-1; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The well-preserved Cretaceous-Tertiary (K/T) boundary Chicxulub crater, in Yucatan, Mexico, lies buried under approximately 1 km of Cenozoic sediments. The conflicting interpretations of size and morphology of the Chicxulub structure, ranging from an approximately 180-km central peak crater up to a 310-km multiring impact basin, demonstrate our limited knowledge of the original structural features of large (>100 km in diameter) terrestrial-impact structures. Only two other large structures are known on Earth: the deeply eroded 2023-Ma Vredefort structure, South Africa, and the 1.85 Ga Sudbury structure. The Sudbury, Canada, structure is highly tectonized, yet still contains a complete section in the central depression ranging from crater-floor lithologies up to the post-impact crater infill. Areas outside the inner ring, however, are eroded to the sub-crater floor level. Analogies of Chicxulub to smaller, well-preserved craters such as the Ries are restricted, since the K/T impact occurred on the continental shelf in an area characterized by an approximately 3-km-thick sedimentary sequence topping Pan-African basement lithologies. Deciphering structural features of Chicxulub thus requires the combination of geophysical data with petrology and shock barometry of the impactites recovered by drilling. So far, relatively few studies have focused on impact lithologies in the crater or its vicinity. We are currently analyzing impactites from the Pemex wells Yucatan 6 and Chicxulub 1 with microscopic, microchemical, geochemical, and isotopic techniques. to detect a possible impactor contamination (”meteoritic component”), we have analyzed Chicxulub core samples for PGE abundance. The Ir content of the Chicxulub impactites appears elevated (15 ppb), but it is heterogeneously distributed in the melt-breccias, perhaps as small Ir nuggets a few microns long. The proposed high meteoritic component of the Chicxulub impactite, combined with the almost uniform Ir-rich layer found at more

than 112 K/T sites worldwide, advocates a much larger impactor than the 10-km object of the original hypothesis, and thus favors the larger crater estimates. Despite the large number of analyses, we could not reproduce the high Ir content given by Schuraytz et al. Iridium concentration was systematically below 0.1 ppb in all 50 samples, and extensive SEM/BSE searches of impact melt-breccia failed to reveal any Ir nuggets. Due to the specific target situation, and the seemingly quick recovery of ”normal” sedimentation in the Gulf of Mexico region, Chicxulub provides a unique opportunity to study the original distribution of e ecta in the near and far vicinity of a large impact crater. Recently, two ODP cruises (leg 165, Nicaragua rise; leg 171b, east of Florida) identified up to 20-cm-thick sequences of proximal ejecta. Analyses of the K/T sequence in Belize and the Gulf of Mexico region show that a large part of the ejecta is made of carbonate material originating from pre-impact platform sediments. In Belize, the K/T boundary is marked by a clastic-matrix breccia composed of huge dolomite blocks. At more distal sites, the ejecta bed is composed of carbonate clasts associated with a few shocked minerals and many clay spherules, some with a preserved impact glass core. Thickness of the ejecta unit ranges from 0.5 to 1 m. It was highly reworked and probably transported by the tsunami waves triggered by the impact. The abundance of carbonate material in the ejecta clearly illustrates the special role played by the approx. 3-mi-thick sedimentary layers of the Chicxulub target. The aerodynamically elongated shape of some of the clasts and its association with glass may indicate that it was transported as molten particles. Other, more angular fragments were clearly ejected as solid particles. For understanding long- and short-term atmospheric effects of the Chicxulub event, it is essential to better confine the phase under which this limestone ejecta was transported--specifically, whether it was transported as solid CaCO3 (and evaporites), as molten or residual CaO, or in vaporized form. Sedimentological and petrographic observations may serve as a test for calculated reactions of CaCO3 to shock loading.
Author
Breccia; Ejecta; Impact Melts; Impactors; Iridium; Meteorite Craters; Projectile Cratering

20000031427 Michigan State Univ., East Lansing, MI USA
Chemical Compositions of Chicxulub Impact Breccias
Corrigan, C. M., Michigan State Univ., USA; Sharpton, V. L., Lunar and Planetary Inst., USA; Vogel, T. A., Michigan State Univ., USA; Marin, L. E., Universidad Nacional Autonoma de Mexico, Mexico; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 10-11; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The excellent preservation state of the Chicxulub structure provides an unprecedented opportunity for studying the debris deposits generated in large-body impact events. The crater formed on a 2-3 km-thick Cretaceous platform underlain by a crystalline basement of Pan-African age. We are examining breccia matrix materials from three holes (U5, U6, U7) drilled into the southern flank of the basin, as well as a selection of Pemex core samples of breccia (Y6-1196m) and basement rocks (Y2-3330m, Y1-3151m). Major- and trace-element analyses have been completed on these breccia samples using X-ray fluorescence (XRF) to determine the chemical compositions of matrix materials and the proportions of individual target lithologies that have been incorporated into these breccias. The results indicate that the matrix of the U5 (about 110 km) breccia samples contains more than two-thirds silicate material. This breccia is predominantly primary ejecta derived from deep crystalline target units. There is only a very small representation of material from the platform sequence in these breccias. This is consistent with previous interpretations of the U5 breccia as crater suevite. In terms of major oxides, the U5 suevite is similar to the breccia from the Y6-N14 core interval collected from near the center of the basin. The U7 (about 125 km) well shows high SiO2 compositions in samples from the upper portion of the breccia sequence. At greater depths, SiO2 appears to be considerably lower, indicating a compositional boundary somewhere between about 350 and 675 m in depth. This is consistent with the inverted stratigraphy present in ejecta from the Ries Crater, Germany, where suevitic breccias lie above bunte breccias in the stratigraphic sequence . These data also indicate that the SiO2 decreases as a function of increasing radial distance, from 40-50% in the U5 samples to -35% in U7 breccias and is less than 5% in U6 (about 150 km). These observations support the basic stratigraphic interpretation that U5 sampled only suevitic breccias, U7 sampled suevites overlying bunte-breccia type deposits, and U6 sampled only bunte-breccia deposits. Additional information is contained in the original (figure, table).
Author
Breccia; Chemical Composition; Trace Elements; Meteorite Craters; Ejecta; Projectile Cratering; Meteoritic Damage

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Funnel-Shaped Emplacement Geometry of the Sudbury Igneous Complex: A Structural Perspective
Cowan, E. J., University of Western Australia, Australia; Schwerdtner, W. M., Toronto Univ., Canada; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 11; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Published emplacement scenarios for the 1.85-Ga Sudbury Igneous Complex (SIC) based on geochemical studies suggest that the complex is either (1) a differentiated impact melt sheet, (2) an impact-induced magmatic intrusion, or (3) a combination of the two processes. Geochemical data do not appear to provide a singular interpretation; therefore, an independent petrofabric study of the SIC phases was conducted to test these rival emplacement models and determine the original geometry of the complex. The impact-melt model requires the melt-body to have been emplaced in a large flat-floored impact crater, with its subsequent differentiation into norite, gabbro, and granophyre phases of the SIC. The folded Whitewater Group, which consists of the fall-back breccia (Onaping Formation) and turbidite deposits (Onwatin and Chelmsford Formations), overlies the SIC. While the folded nature of the Whitewater Group is well documented, the mechanism of how the SIC assumed its present funnel-shaped geometry has not been thoroughly examined. Linear-planar (L-S) igneous mineral fabrics, initially identified with the aid of anisotropy of magnetic susceptibility (AMS), were confirmed by image analysis of unstrained gabbro and norite samples collected in the SIC. The igneous foliation (S) is subparallel to the inclined contacts of the SIC, while the mineral lineation (L) is parallel to the dip-direction at each site. This pattern is consistent with an apparent radial arrangement of L within the SIC, with the L trajectories converging in the center of the Sudbury Basin. Qualitative models for several emplacement scenarios are compared with the regional igneous fabric pattern of the SIC gabbronorite. of these models, only intrusion scenarios dominated by frictional shearing between the wall and the magma and gravitationally driven reorientation of minerals within the magma chamber explain the radial pattern of L. The L pattern cannot be reconciled with crystal settling and convection in a horizontally ponded impact melt. The occurrence of similar L-S fabrics in the gabbro and norite phases implies that the processes responsible for the mineral fabric persisted during magmatic fractionation. This suggests that gravitationally driven magma readjustments are likely to be responsible for the L-S fabrics, which is consistent with a basin- or funnel-shaped geometry for the SIC at the time of its solidification. Similar radial arrangements of mineral lineation have been documented in other funnel-shaped mafic intrusions but have not been identified in impact melt bodies. In contrast to the contact-parallel orientation of the gabbro/norite mineral foliation, the granophyre is characterized by contact-orthogonal mineral lineation. The largely undeformed nature of this crescumulate fabric in the ”north lobe” of the Sudbury Basin indicates that the SIC was not folded with the Whitewater Group. Instead, the low strain levels (is less than 15% shortening strain as estimated from AMS numerical modeling) recorded by the granophyre in the north lobe is consistent with the SIC intruding along a curved interface between the Whitewater Group and the basement rocks. This pre-intrusive curvature, with dips of up to 70 deg, may have resulted from folding; however, it is more likely that it was a topographic feature created during the impact event.

Author

Breccia; Impact Melts; Meteorite Craters; Ejecta; Meteoritic Composition; Projectile Cratering

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Sudbury: Geochemical Evidence for a Single-Impact Melting Event

Dickin, A. P., McMaster Univ., Canada; Crocket, J. H., McMaster Univ., Canada; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 11-12; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Early geochemical investigations on the Sudbury Igneous Complex led to its interpretation as a single stratified body. The increasing weight of evidence favoring an impact origin for Sudbury has led to wide acceptance of the upper parts of the complex as crustal melts, but this has been accompanied by suggestions of a separate origin for the lower parts of the complex. We have argued in the past for an impact-melting origin for the basal units of the complex, based on their Os-isotope signature and the similarity of their isotopic signatures to shock-melted Sudbury breccias. However, petrological and geochemical evidence must also be examined to understand the internal relationships between the lower and upper parts of the complex. Petrologically, there is evidence for gradational contacts between the main units of the complex (norite, oxide-gabbro, and granophyre), and their major-element chemistry can be explained by crystal fractionation from a single parent magma. These relationships can be tested by ratios of incompatible trace elements and isotopes. For example, Ce/Yb ratios in the upper and lower parts of the complex show much greater similarity with each other than with most of the possible crustal sources of the complex, and these ratios also show a tendency toward reduced variability in the upper parts of the complex. Isotopic evidence points to a similar process of homogenization in the upper part of the complex. Generally, Pb, SR, and Nd isotopic variation decreases in the following sequence: Country rocks-Sudbury breccias-Sublayer inclusions and norites-Main Mass norite gabbro, and granophyre. However, Pb, Nd, and SR isotopic systems are partially decoupled from one another, so (1) Pb isotope ratios reflect the variable metamorphic grade of crustal target rocks (greenschist to granulite); (2) Nd isotope ratios reflect the variable petrology of target rocks (gabbro to granite and sediment); and (3) SR isotope ratios reflect a combination of these controls. The detailed behavior of these isotopic systems will be examined at different locations around the margin of the complex.

Author

Breccia; Meteorite Craters; Impact Damage; Impact Melts; Isotopes

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The Separation of Platinum and Palladium During High-Temperature Vaporization of Sulfide-Rich Picrite

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We have investigated experimentally the separation trends of Pt and Pd during high-temperature vaporization of ultramafic rocks. This experiment was aimed at the simulation of hypervelocity impact-induced vaporization of a hypothetical meteorite. The samples for investigation were prepared as a 1:1 mixture of picrite from norilsk-differentiated intrusion and sulfide concentrate with a high concentration of Pt metals from the same intrusion. The composition of the picrite (in weight percent) was 39.5 SiO2, 0.6 TiO2, 6.5 Al2O3, 6.9 Fe2O3, 9.3 FeO, 26.5 MgO, 4.5 CaO, 0.4 Na2O, 0.2 K2O, 0.5 Cr2O3, 2.7 H2O(-), and 2.5 H2O(+). The composition of the sulfide concentrate was (in volume percent) about 62 hexagonal pyrrhotite, about 22 pentlandite, and about 16 chalcopyrite. The concentration of the sum of Pt + Pd in the sulfide concentrate was 5 wt%. The atomic ratio of Pt/S is 0.13; the atomic ratio of Pd/S is 0.48. High-temperature vaporization was performed using a powerful pulse-laser installation. The parameters of the laser pulse were (1) pulse luminous energy about 600 J, (2) duration of pulse about 10(exp -3) s, and (3) density of luminosity about 10(exp 7) W/square cm. The temperature of vaporization was 4000-5000 K. The condensate was collected on a Ni-foil placed about 7 cm from the sample on the path of spreading of the vapor cloud. The condensed film was analyzed using an X-ray photoelectron spectrometer (ES-2401). The XPS analysis of the internal chemical composition of the condensed film was provided layer by layer, with an argon-ion etching of 400 Angstroms of the film per step. Some results of the measurements of element concentration at different levels (at the surface of the condensed film and at depths 400 and 800 Angstroms from the surface) inside the condensed film are presented (concentrations are in weight percent). The results of analysis indicate a selectivity of vaporization. The vapor is enriched in Si and S. The ratio of Si to Mg in the surface layer is 8.9, compared to 1.4 in the initial sample. The condensate has a distinct zone separation of Pt and Pd. The concentration of Pd in the condensate correlates well with the concentration of S. The concentration of Pt has an anticorrelation with the concentration of S. The observation speaks for the chemically driven space separation of Pt and Pd during high-temperature vaporization of sulfide-silicate mixtures. Additional information is included in the original (table).

Author

Chemical Composition; Meteorites; Mineralogy; Olivine; Palladium; Platinum; Meteoritic Composition; Meteorite Craters; Impact Melts; High Temperature

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The Sudbury Structure, Ontario, Canada: A Persistent Enigma

Dressler, B. O., Lunar and Planetary Inst., USA; Sharpton, V. L., Lunar and Planetary Inst., USA; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 12-13; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The impact origin of the Sudbury Structure (SS) has gained wide acceptance over the last 15 years. Disagreement remains, however, concerning several aspects of the impact structure, including the origin of the Sudbury Igneous Complex (SIC). Likewise, important questions remain as to the predeformation size of the SS, the distribution and origin of pseudotachylites (Sudbury breccias) in the footwall rocks around the SIC, and, possibly, the significance of high-precision geochronological age determinations for various rock units associated with the SS. In the past, the SIC has been interpreted as a strongly crustal-contaminated, differentiated magmatic body. On the other hand, isotopic evidence has been used to argue for an impact-melt origin for all the SIC. The ratios of incompatible trace elements of the granophyre are similar to those in the norites, supporting a one-magma (impact) origin for the SIC. Yet other geochemical data have been interpreted as supporting a two-magma origin, in which an impact melt, the granophyre of the SIC, overlies an endogenic, noritic-quartz dioritic rock. Structural observations and intrusive relationships between various units of the SIC also seem inconsistent with an impact origin for all or part of the SIC.. An open-minded reevaluation of geochemical and structural data is needed to advance our understanding of the SIC. On the basis of the distribution of shatter cones, shock metamorphic features, and pseudotachylites (Sudbury breccias) in the footwall rocks beneath the SIC, the SS is estimated to be 190-280 km in diameter . Based on the interpretation of vibroseismic profiles across the SS, however, it can be surmised that the structure originally may have been considerably larger. Erosion, estimated to have amounted to 9.5 +/- 2 km since 1.25 Ga, complicates attempts to estimate the preerosion and predeformation size of the structure. Present estimates may be conservative. There is no consensus on the origin of Sudbury breccia (pseudotachylites) or their orientation and distribution in the footwall rocks around the SIC. Rock comminution, friction melting due to impact, or some combination of these two processes have all been suggested as possible explanations for the

pseudotachylites (in contrast to a recent controversial interpretation that Sudbury breccia is related to basaltic magmatism. It has been proposed that the distribution of the breccias is linked to the rings of a Sudbury multiring impact basin. Further research is needed to substantiate the proposed continuity of breccia bodies around the SIC. All units of the SIC, including ultramafic inclusions in the sublayer (the ore-bearing unit at the base of the SIC), have been dated radiometrically at - 1.85 Ga. Recently, Early Proterozoic and Archean (preimpact) target rocks, located near the contacts with units of the SIC, have been dated at about 1.85 Ga; these results suggest that the U-Pb clock was reset at that time. These results may warrant a reevaluation of the significance of geochronological data, especially in view of results presented in two recent dissertations on the SIC and its footwall rocks. Is it conceivable that the 1.85-Ga age does not represent a melting/crystallization age for all components of the SIC? Author

Breccia; Geochronology; Craters; Impact Damage; Ejecta; Meteorite Craters; Projectile Cratering; Meteoritic Damage

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Review of the Geophysical Signature of the Vredefort Structure and its Interpretations

Durrheim, R. J., Council for Scientific and Industrial Research, South Africa; Reimold, W. U., Witwatersrand Univ., South Africa; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 13-14; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The surface geology of the Kaapvaal Craton is characterized by the exposure of several basement granitoid domes. One such dome, located in the center of the Witwatersrand structural basin, differs from the others in that there is abundant evidence (including pseudotachylitic breccia, shatter cones, high-pressure polymorphs of quartz, and shock-metamorphic effects in quartz and zircon) that the structure was formed as the result of unusual dynamic processes. Many workers are satisfied that the Vredefort Structure is the result of a large meteorite or comet impact event; others still vigorously argue for an origin linked to internal agents. Comprehensive gravity, aeromagnetic, refraction, and reflection seismic data cover the entire Witwatersrand basin. While this contribution serves to review the entire database, the salient geophysical characteristics of the Vredefort Dome shall be highlighted. The gravity signature of the Vredefort Dome differs from that of other granitoid domes, which are usually characterized by negative gravity anomalies. This is because basement granite typically has a density of 2.65 g/cu-cm--considerably less than the densities of the indurated shales, carbonates, and igneous rocks that make up the supracrustal strata. A 30-mGal positive Bouguer anomaly is centered on the approximately 40-km-diameter core of the Vredefort Dome. Stepto modeled this anomaly using a vertical, 5-km-wide cylinder of 2.94 g/cu cm density surrounded by an annulus of 18-km width and 2.73 g/cu cm density. The interpretation of the gravity field is inherently ambiguous, and more recent models have been constrained by new seismic and geological data and have inclined rather than vertical boundaries between units. A 36-km seismic refraction profile was surveyed by Green and Cherry. The Outer Granite Gneiss zone, forming an outer annulus in the core of the dome, yielded 5.9-6.1 km/s velocities, whereas velocities of 6.4 km/s were reliably defined in the center of the dome. A seismic-refraction profile was surveyed between Witbank and the Free State goldfields using mine tremors as the energy source. Clear Pn arrivals were observed, corresponding to a 36-km Moho depth. There is no evidence of a significant deviation in Moho depth beneath the Vredefort Dome. A remarkable feature of the magnetic field over the Vredefort Dome is a horseshoe-shaped negative-magnetic anomaly situated about 8 km from the perimeter of the granitoid core. A magnetiterich zone has been inferred here by Corner et al., which, according to Hart et al., has distinct geochemical properties (a sharp increase in the ratio between light and heavy REE, anomalous U, and volatile element abundances). This magnetic zone has been correlated with magnetic anomalies found near the craton margin and proposed as a semicontinuous intracrustal zone. Prominent reflections observed on reflection-seismic sections have been tentatively correlated with this inferred magnetite-rich layer. Such reflections are observed, for example, beneath the Westerdam Dome at the northwestern margin of the Witwatersrand structural basin and can be traced beneath the supracrustal strata to a point near Potchefstroom, some 40 km northwest of the collar of the Vredefort Dome. From this point onward onto the Dome, the basement becomes seismically transparent. This transparency has been linked to deformation caused by the catastrophic Vredefort event. The gravity, magnetic, refraction, and reflection seismic data provide constraints on the geometry of the Vredefort Structure, but these data are equivocal with regard to its formation mechanism. Progress can only be made by integrating the geophysical data with other geological information.

Author

Breccia; Cratons; Geophysics; Meteorite Collisions; Structural Basins; Geology; Granite; Meteoritic Damage; Meteorite Craters; Projectile Cratering

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Base of the Rooiberg Group: Evidence for an Initial Bushveld Catastrophe

Elston, W. E., New Mexico Univ., USA; Caress, M. E., New Mexico Univ., USA; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 14; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Rocks at the basal contact of the Rooiberg ”felsite” group, the earliest component of the Bushveld Complex, provide evidence for a high-temperature, high-energy catastrophe. These rocks differ, however, from all previously described volcanites and impactites and include (1) meltrocks with textural evidence for superliquidous heating followed by subsolidus undercooling; (2) high-temperature, high-energy debris flows (including pseudoignimbrites); and (3) underlying Pretoria Group arenite recrystallized to pseudofelsite by contact metamorphism. The basal zone was studied in two locations where it rests on the Pretoria Group without intervening sills of bushveld-layered gabbro and granite: (1) proximal outflow in the Stavoren ”fragment,” interpreted as an allochthonous block that slumped into a transient cavity during enlargement, and (2) distal outflow in the type-Dullstroom Formation, a sliver of the lower Rooiberg preserved beneath layered gabbro. In the Stavoren ”fragment,” the sharp contact between the Pretoria and Rooiberg groups recognized by previous workers has turned out to be a false contact between quartzite and pseudofelsite. Directly beneath the false contact, subgraywacke has recrystallized into quartzite with a coarse metamorphic fabric. The quartz grains are intensely strained and commonly divided into mosaics. Parallel and closely spaced fractures and twins with extinction angles to 4 deg are currently being investigated using optical microscopy and transmission electron microscopy (TEM). Within each mosaic domain, these fractures and twins have a single direction, but they may intersect near domain boundaries (cf. Brazil twins at Vredefort). In a is greater than = 10-m zone of pseudofelsite above the false contact, quartz grains are replaced by a network of quartz needles and laths measuring up to -0.5 cm formerly interpreted as plagioclase or quartz pseudomorphs after plagioclase. TEM studies have confirmed that these needles and laths are quartz paramorphs after high tridymite. In silicabrick furnace linings, quartz-high tridymite inversion occurs at is greater than = 1200 C , while inversion back to quartz occurs at - 1125 C. Contact metamorphism on this scale is unknown beneath siliceous, volcanic rocks, but quartz needles have been found in siliceous meltrock at the base of the Onaping Formation at Sudbury. Pseudofelsite is isochemical with underlying arenites; rare relict cross-beds confirm its sedimentary nature. Above a true contact, a basal-debris-avalanche deposit of the Rooiberg Group superficially resembles spherulitic rhyolite with a matrix of quartz needles and vague meter-sized pale patches. In ”cool” spots, the patches resolve into angular quartzite clasts in a sandy matrix. In a paleochannel, a debris flow scoured a polished, striated, and mullioned pavement. True meltrock with skeletal quench textures, no longer isochemical with arenites, appears above the basal-debris flow. Pseudoignimbrite, preserved at the base of the Dullstroom Formation in paleochannels (gouges?) radial to the Bushveld Complex, is interpreted as the distal facies of a hot debris flow. As in true igaimbrite, basal surge beds are overlain by a 25-m massive zone (cf. suevite) with abundant homfels clasts. However, sand-sized quartz grams supported by chloritic matrix, rather than glass shards, make up the groundmass. Pumice fiamme is replaced by amphibolite lenses with pyrite cores and quartz coronas, evidently metamorphosed in situ. The overlying rhyolite-like unit has similar amphibolite lenses, but the quartzose matrix has a metamorphic fabric. Contorted flow bands show that the rock was hot and mobile (cf. rheoignimbrite). The temperatures and energies required by these rocks are consistent with a megaimpact resulting in meltdown and obliteration of conventional shock criteria. Constraining the solid-liquid phase relations is more speculative.

Author

Gabbro; Felsite; Metamorphic Rocks; Craters; Meteorite Craters; Impact Damage; Ejecta

20000031434 Falconbridge Ltd. (Exploration), Ontario Canada

Classification and Distribution of Sudbury Breccia

Fedorowich, J. S., Falconbridge Ltd. (Exploration), Canada; Rousell, D. H., Laurentian Univ. of Sudbury, Canada; Peredery, W. V; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 14-15; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

In its occurrences circumferential to the Sudbury Basin, three principal types of breccia have been recognized within the rock unit known as Sudbury Breccia: (1) Flow-surface Sudbury breccia is characterized by well developed surfaces indicative of laminar (originally turbulent?) flow; (2) chaotic Sudbury breccia is characterized by unoriented, subrounded to angular fragments supported in a cataclastic matrix derived by mechanical fragmentation of the host rock and subsequent sliding rotation and milling; and (3) igneous texture Sudbury breccia consists of a fine-grained primary intergrowth of felsic and mafic minerals. In terms of distribution, type 1 is most abundant on the South Range, whereas type 2, intermixed with subsidiary type 1, dominates elsewhere along the basin margin. The overall abundance of igneous texture breccia is the most difficult to estimate, but this breccia type appears to be far less abundant However, it is also the most difficult to recognize, and it is only unambiguous in a thin section. Distribution patterns and brecciation intensity are generally not well constrained within the 5-15-km-wide collar containing minor to moderate amounts of Sudbury breccia. In an effort to quantify the percentage distribution of Sudbury breccia, measurements have been made from detailed outcrop mapping. For example, 1-km(exp 2) areas are found to contain 2-5% Sudbury breccia within the total exposed area. At the scale of individual outcrops, this Sudbury breccia occurs both as discrete dikes (average outcrop area = 0.00025 km(exp 2)) and as ramifying vein networks. Detailed underground mapping reveals a similar overall

distribution. In terms of orientation, there is a strong clustering subparallel to the basin margin and a decrease in dip angle with depth.
Author
Breccia; Mineralogy; Minerals; Geology

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Impact Materials with Mixed Compositions of Iron-Silicon-Nickel-Sulfur System
Fukuyama, S., Yamaguchi Univ., Japan; Miura, Y., Yamaguchi Univ., Japan; Kobayashi, H., Yamaguchi Univ., Japan; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 15; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

There have been few systematic reports on the indicators of impact composition and structure. Impact craters on Earth are considered to have been formed by Fe-meteorite bombardments, since atmospheric effects can stop direct impacts of comets or stony meteorites. The main purpose of this study is to elucidate the characteristic signatures of impact composition. Composition of Iron-Nickel-Silicon-Magnesium-Sulfur: NASA's Johnson Space Center has conducted reports on the systematic composition of impact spherules and fragments. Analytical electron microscopical (AEM) data of these particles on Earth are summarized as follows: (1) The meteoritic origin (shown as C of the particles is 41% (from 403 analyses), with mixed composition of Fe-Ni-Si-Mg-S system; (2) terrestrial contamination from natural particles (shown as TCN) from volcanic ashes is 10% (from 403 analyses), with mixed composition of Si-Al-Na-K-Ca-Fe system and a few atoms of Ni, S, or Mg; and (3) mixed compositions from meteoritic and terrestrial sources, classified as unknown particles, are used for significant information on exposed terrestrial impact craters. Meteoritic Impact Composition: Meteoritic compositions of Fe-Ni and Fe-Ni-S are melted from kamacite and troilite, respectively. Compositions of Si-Mg-Fe are believed to have originated from the olivine or pyroxene of a chondritic meteorite. With Mg and Fe elements, however, it is difficult to identify the sources on the terrestrial surface. Therefore, the characteristic composition of an impact on the terrestrial surf-ace is represented as Fe-Si-Ni-S system in this study. The particles formed by impacts are spherules, fragments, or micrometer-sized. Spherules from the Cretaceous-Tertiary Geological Boundary: Spherules from the Cretaceous-Tertiary (KT) geological boundary, which was formed by impacts on Middle America, were distributed on a global scale and show a Fe-Si-Ni-S composition in Danish samples . This indicates that the KT boundary is confirmed by the spherule composition of Fe-Si-Ni-S system. Impact Craters on the Earth: The Barringer (USA), Wolf Creek (Australia), and Ries (Germany) impact craters show mixed impact composition of Fe-Si-Ni-S system. The Takamatsu crater shows anomalous grains of Fe-Si-Ni-S system, though there is some contamination of Cl, Ti, or Al. The Akaogi crater of Anami-Ohshima shows 26% grains from a meteoritic impact origin of the Fe-Si-Ni-S system and 74% grains from a terrestrial igneous origin as mixed compositions. Referenced data of Unzen volcanic ash show a Si-Fe-Ti-Al-Mg-K system from feldspar or mafic compositions in particle grains. Additional information is contained in the original (Table).
Author
Comets; Composition (Property); Craters; Meteorites; Stony Meteorites; Cometary Collisions

20000031436 Academy of Sciences (USSR), Space Research Inst., Moscow, USSR
Experimental Investigation of the Chemistry of Vaporization of Targets in Relation to the Chicxulub Impact
Gerasimov, M. V., Academy of Sciences (USSR), USSR; Dikov, Yu. P., Academy of Sciences (USSR), USSR; Yakovlev, O. I., Academy of Sciences (USSR), USSR; Wlotzka, F., Max-Planck-Inst. fuer Chemie, Germany; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 15-16; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Chicxulub impact is considered to be a possible cause for Cretaceous-Tertiary mass extinction. The presence of thick deposits of anhydrite and carbonates in the target rocks resulted in the evolution of enormous quantities of S- and C-containing gases. In addition, these deposits resulted in the synthesis in the ejecta of noticeable quantities of various species such as S acid aerosols that could strongly affect the biosphere. The purpose of our experiment was to investigate the chemical products of high-temperature vaporization of target rocks of the Chicxulub impact structure. We have prepared different samples from mixtures that could qualitatively simulate the real target. We have used pure anhydrite and gypsum minerals, and some of the targets were prepared from a pressed powder mixture, such as CaSO4 CaSO4Sigma2H20 + CaCO3 + SiO2 MgCO3 + CaCO3 + CaSO4Sigma2H2O + SiO2 + Al2O3. For investigation of Ca-Si and C high-temperature chemistry, we used spurrite (Ca2SiO4SigmaCaCO3) from South Yakutia and a compressed mixture of fine powders of CaC03 and Si02 with the same atomic Ca/Si ratio as in spurrite. High-temperature vaporization was provided using a powerful neodymiurn glass pulse laser. Samples were vaporized in a cell filled with air at I atm room temperature. Condensate was collected on a Ni foil placed on the path of a spreading evaporated cloud at a distance of 6 cm. The analysis of condensed film was conducted using X-ray photoelectron spectroscopy (XPS). A film of condensate was etched layer by layer (with a step ranging from 100 to 400 Angstroms) by Ar ions

and for every step XPS analysis was performed, providing a cross-section of the film. XPS analysis provided information on both the elemental composition and charging state of elements. A large portion of S is present in the condensed films in the form of adsorbed SO3, proving the possible presence of S acid aerosols in the expanding vapor plume. About 40% of S and from 40% to 60% of C from the vapor cloud is trapped as condensate. The main phase of S in the condensate is CaSO4 Carbon is present in the condensate as carbonate, but in some cases the condensate contains about half of the C in reduced phases. Complex redox processes occur in the vapor cloud at dry conditions, providing some Si in metallic form and half of the C in graphite form. The reduction of Si was computed as up to 9% of total Si. Different forms of reduced C were identified, including C as graphite, Si carbide, and complex organic C agglomerates. Analyses indicate the presence of complex C aggregates such as C38 and C48. The presence of Si in a sample provides for more efficient volatilization of S, since a part of the Ca bonds with Si to produce Ca silicates. Analyses of the structural state of Si in condensates show the existence of mineral embryos of wollastonite and larnite groups. This could be the result of the production of a full range of Ca silicates. The presence in the vapor cloud of such volatiles as water, S, and C makes possible the origin in condensed phase of such rare minerals as ellestadite Ca5[OH/(SiO4,SO4)], spurrite Ca5[CO3/(SiO4)2], and thaumasite Ca3H2[CO3/SO4/SiO4]Sigma13H2O. Experiments also prove the formation of sheet Mg-silicates and hydrous alumosilicates, which can be a good source for smectite clay formation.
Author
Aerosols; Ejecta; High Temperature; Vaporizing; Carbon; Sulfur; Meteorite Collisions

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The Onaping Formation: Stratigraphy, Fragmentation, and Mechanisms of Emplacement
Gibbins, S. F. M., Falconbridge Ltd. (Exploration), Canada; Gibson, H. L., Laurentian Univ. of Sudbury, Canada; Ames, D. E., Geological Survey of Canada, Canada; Jonasson, I. R., Geological Survey of Canada, Canada; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 16; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The 1400-m-thick, Paleoproterozoic Onaping Formation is the lowermost formation of the Whitewater Group, the basin-fill succession of the Sudbury Structure. The Onaping Formation consists of ”glass-rich” breccias and coeval hypabbysal intrusions that overlie the Sudbury Igneous Complex and are conformably overlain by the Vermilion, Onwatin, and Chelmsford Formations. The Onaping Formation has been subdivided into upper Black and lower Gray members on the basis of C content (color). However, because the occurrence of C is not a reliable stratigraphic criterion and is often discordant, the Onaping Formation was informally subdivided, on the basis of shard morphology and the percentage of shards is greater than 1 mm, into a lower Sandcherry member and an upper Dowling member. The Sandcherry member consists of peperitelike, massive and brecciated fluidal breccia complexes where a ”melt” was emplaced into preexisting breccias and interacted with water, both passively and explosively, to form proximal ”hyaloclastites.” These hyaloclastites were redeposited by mass flows to form widespread, coarse, shard-rich, and matrix-poor units. Contacts between depositional units are not distinct, but are marked by a rapid variation in grain size and/or the occurrence of large blocks (>64 mm). The Dowling member is interpreted to be the product of a more explosive and renewed interaction of a ”melt” with water and the explosive exsolution. of volatiles (vesiculation), which resulted in the deposition of primary fall and finer, shard-poor, and matrix-rich, mass flow deposits. The contact between the Sandcherry and Dowling members marks a rapid stratigraphic change in the percentage of matrix, morphology and size of shards, percentage of lithic fragments, and depositional character of units. The lower or contact unit of the Dowling member is locally welded. Thus, contrary to previous work, the Onaping Formation is not a succession of ash-flow tuffs and lavas as proposed by Thompson, Williams, and Stevenson, nor is it a fall-back breccia as proposed by French, Dence, Peredery, Morrison, and Averman. The Onaping was emplaced by the continuous introduction of a ”melt” of uniform composition, both passively and explosively, at surface level in a shallow subaqueous to locally subaerial setting. Ile melt may represent a contaminated magma or melt derived from an underlying impact melt sheet that consumed its fallback breccia. Regardless of the melt’s origin-i.e., impact or contaminated magma-the Onaping was fragmented and emplaced by explosive and passive hydroclastic processes. lithic fragments, and depositional character of units. The lower or contact unit of the Dowling member is locally welded. Thus, contrary to previous work, the Onaping Formation is not a succession of ash-flow tuffs and lavas as proposed by Thompson, Williams, and Stevenson, nor is it a fall-back breccia as proposed by French, Dence, Peredery, Morrison, and Averman. The Onaping was emplaced by the continuous introduction of a ”melt” of uniform composition, both passively and explosively, at surface level in a shallow subaqueous to locally subaerial setting. Ile melt may represent a contaminated magma or melt derived from an underlying impact melt sheet that consumed its fallback breccia. Regardless of the melt’s origin-i.e., impact or contaminated magma-the Onaping was fragmented and emplaced by explosive and passive hydroclastic processes.
Author
Breccia; Fragmentation; Intrusion; Stratigraphy; Geochronology; Morphology; Meteorite Craters; Meteoritic Damage; Cones (Volcanoes)

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Diagnostic Criteria for the Recognition of Shatter Cones

Gibson, H. M., New Brunswick Univ., Canada; Spray, J. G., New Brunswick Univ., Canada; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 16-17; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Shatter cones are commonly described as being conical, striated fracture surfaces formed as a result of hypervelocity impact. Other structures having similar, but not identical, morphological elements include blast fractures, natural percussion marks, slickensides, wind-abrasion structures, and cone-in-cone structures. Precise identification of shatter cones is necessary to prevent confusion with these similar structures. Criteria for the identification of shatter cones are based on elements of their morphology combined with field habit. Three basic criteria must be met for a structure to be considered a valid shatter cone: (1) The structure must be a conical, or partconical fracture surface; (2) ridge and groove striations diverging from an apex or central striae must be present; and (3) the structure must be pervasive and not surficial. Blast fractures are true fracture surfaces but do not display a conical fracture surface. Most commonly, they consist of a radiating array of planar fractures. Percussion marks result from the impact of boulders in a rapid flow, fluvial setting. They have a conical fracture surface that may include crude striations, so their morphology is superficially similar to that of a shatter cone. However, their occurrence is restricted to the outcrop surface and, as such, they do not form a pervasive fracture system. Slickensides have ridge and groove striations similar to those of a shatter cone. However, the fracture surface is planar, or occasionally curviplanar, and lacks the conical shape and divergent striations of shatter cones. Cone-in-cone structures are not fracture surfaces, but are displacive growths of calcite within a carbonate-rich sediment. As such they possess a characteristic internal structure that is distinct from that found in shatter cones. Conical structures formed as a result of wind abrasion lack a fracture surface and are spatially restricted to outcrop surfaces and prevailing wind direction at the time of formation. If care is taken, the above evidence can be used to distinguish true shatter cones formed by hypervelocity impact from other conelike structures at the mesoscopic scale (i.e., in the field). At the microscopic scale, shatter cones may be further distinguished by the localization of planar deformation features (PDFs) in the vicinity of the cone surfaces, as well as by the presence of spherules (vapor condensates) and high-pressure polymorphs indicative of shock.

Author

Hypervelocity Impact; Shatter Cones; Striation; Geomorphology; Structural Properties (Geology); Projectile Cratering; Meteoritic Damage

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Multiple Origins for Impact-Produced Diamonds

Gilmour, I., Open Univ., UK; Hough, R. M., Open Univ., UK; Pillinger, C. T., Open Univ., UK; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 17; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A genetic link between diamonds and terrestrial impact was initially proposed to explain the occurrence of diamonds in the Canyon Diablo meteorite found at Meteor Crater in Arizona. It was suggested that the diamonds had been produced by the shock transformation of meteoritic graphite in situ. Direct evidence for the shock production of diamonds was first observed in experiments involving explosions. Several classes of meteorites have since been identified that contain microcrystalline diamond aggregates thought to be produced by impacts with the Earth or in space. Primitive chondrites also contain diamonds, but these nanometer cubicform crystallites are circumstellar vapor phase condensates. On Earth, some diamonds thought to have originated from giant impacts occur as placers. Diamonds directly related to craters, particularly the 100-km crater Popigai, are described in studies by Masaitis. Other authors have proposed that giant Precambrian impacts in sedimentary structures produced the carbonado found as placers, which reach 300 g in size, in Brazil and the Central African Republic. At the other end of the scale, nanometer-sized diamonds have been found at the Cretaceous-Tertiary boundary. Evidence for Shock Formation: Koeberl et al. have reexamined diamonds from the Popigai impact structure. Diamonds were found in impact melt and breccias, where they apparently preserve the crystallographic habit and twinning of graphites. From this it was concluded they had formed by shock transformation. Electron microscopy indicated that the samples were polycrystalline and contained very fine lamellae (or stacking faults), although the hexagonal polymorph of diamond, lonsdaleite, could not be unequivocally identified. Infrared spectroscopy of Popigai diamonds indicated the presence of solid CO2 and water in microinclusions in the diamonds, with the CO2 under a pressure of 5 Gpa (at room temperature). Similar C isotopic compositions for Popigai diamonds and graphite lend support to a shock origin for these particular diamonds. Evidence for Vapor Phase Formation: Hough et al. undertook a detailed examination and search for diamonds in Suevites from the Ries Crater, Germany. Acid dissolution techniques enabled diamond plates (up to 100 microns) and fine-grained diamond/Si carbide aggregates (up to 200 microns) of a never-previously-encountered morphology to be isolated. Individual SiC crystals up to 100 microns were also observed. Together these minerals constituted about 4-5 ppm by weight of the original impact-produced rock and were identified by chemical analysis, single-grain X-ray, and electron

microscopy; diamond and SiC were verified by electron energy-loss spectroscopy. The C in the samples burned at temperatures below 700 C suggesting that fine-grained composites contribute most of the mass. The close association between the diamond and Si carbide and the presence of SiC in the aggregates and as single grains had not previously been reported. SiC is not mentioned among the products of shock experiments performed under a variety of conditions to produce diamond. However alpha-SiC can be produced from a vapor containing Si and C created by shaped-charge experiments to shock-powdered beta-SiC. In chemical vapor deposition (CVD) type experiments, diamond grows on Si containing substrates and does so via an interfacial layer of 4H-SiC.

Author

Diamonds; Meteorite Craters; Meteorites; Precambrian Period; Vapor Phases; Meteoritic Composition; Meteoritic Microstructures; Hypervelocity Impact; Geochronology; Meteoritic Diamonds

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Asteroid/Comet Mega-Impacts and Mantle Melting Episodes: Consequences for Precambrian Crustal Evolution

Glikson, A. Y., Geospectral Research, Australia; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 17-18; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The episodic short-lived nature of peak igneous and tectonic Precambrian events is difficult to reconcile with models of continental growth that hinge exclusively on the operation of continuous plate tectonics and arc-trench accretion or underplating processes. Some of these tectonic-thermal episodes potentially reflect the distal consequences of mega-impact by large-diameter (D(sub p)>>5 km) projectiles on thin, tectonically mobile and geothermally active crustal domains--i.e., a Precambrian simatic crust overlying a relatively thin (is less than 20 km) lithosphere. Large impacts (D(sub p)>>10 km) can be expected to bigger global sublithospheric perturbations associated with local to extensive partial melting. Mega-impact effects can thus span a complete spectrum, from clearly recognizable proximal structural and shock metamorphic features (breccias, shatter cones, shock lamella, high-pressure polymorphs, pseudotachylite, and melt breccia) to distal impact-triggered formation of dike swarms related to deep lithosphere-penetrating faulting and asthenospheric melting. Such events may be difficult to recognize in view of (1) heat transfer from impact-rebounded adiabatically-melting mantle and related igneous activity, which is capable of overprinting proximal shock metamorphic effects through recrystallization and superposed deformation, and (2) widespread elimination of the proximal effects of mega-impacts by erosion of elevated terrains, burial, and subduction. For these reasons, distal impact deposits furnish the key for unraveling the Precambrian impact history. These deposits include olistostromes, diamictites, turbidity currents, microtektites, and microkrystites (spherulitic condensates of vaporized asteroid and target materials) accompanied by geochemical anomalies (Pt group elements). The release of energy on a scale is greater than or = 10 (exp 9) Mt, triggering seismic activity orders of magnitude higher than purely endogenic perturbations, results in mega-earthquake-triggered slumps, turbidity currents, and mudflake conglomerates-the latter representing the seismic disturbance of sea-bottom sediments and concomitant deposition from quake-generated turbidity flows. The identification of the signatures of such events in the Precambrian crustal records requires a reexamination of the evidence. Further evidence may be provided by the reexamination of the parts of batholiths representing exhumed reactivated basement of major volcanic sequences. Clues for major impact events and bombardment periods are provided by comparisons between the isotopic ages of preserved impact signatures, dike swarms, volcanic sequences and alkaline intrusions, and thermal peaks on isotopic age distribution histograms. Tentative results of attempted correlations are encouraging, if inconclusive: (1) ca. 3.45 Ga: peak formation of greenstone-granite terrains; minor traces of possible impactite horizons in the Kaapvaal Craton (Zwartkopie Formation and Barberton Mountain Land) and the Pilbara Craton (Salgash Subgroup and North Pole dome). (2) ca. 3.2 Ga: rifting and clastic sedimentation, i.e., (a) Fig Tree Group, Kaapvaal Craton, South Africa, including a basal microkrystite unit, and (b) De Grey Group (Pilbara Block, Western Australia). (3) ca. 3.0 Ga: global greenstone-granite events; no impact correlation identified to date. (4) ca. 2.7-2.67 Ga: global greenstone-granite peak events; a possible clue for impacts from microkrystite horizons in the Jeerinah Formation (2.69-2.68 Ga), Hamersley Basin, Western Australia; a search is continuing for buried impact structures underlying Late Archaean continental basalts in Western Australia. (5) ca. 2.5-2.45 Ga: emplacement of global mafic dike swarms; deposition of microkrystite beds, i.e., Wittenoom Formation, Carawine Dolomite (Hamersley Basin, Western Australia), Lokamonna Formation (west Transvaal). (6) ca. 2.05-2.02 Ga: initiation of global Proterozoic rift networks; Vredefort dome impact structure and emplacement of the Bushveld Complex of possible impact origin. (7) ca. 1.85-1.80 Ga: peak rifting and igneous activity in mobile belts; Sudbury Impact Structure (Ontario) and Uppland (Sweden) possible impact structure. (8) ca 1.4 +/- 0.2 Ga: the Morokweng impact structure (diameter = 340 km), southern Kalahari; a more precise age is needed for correlations. (9) ca. 1.21.05 Ga (Grenvilleanl/Keweenawan): global rifting and magmatic activity; probable impact structures in Sweden. (10) ca. 0.7-0.5 Ga (Vendian-Early Cambrian): global rifting, ocean-floor spreading (Iapetus Ocean), and igneous activity (Franklin Province, Canada); several impact structures, including the Beaverhead (Canada), Act== (South Australia), and Janisjarvi (Karelia). Preliminary time-series analyses of Precambrian events yield values consistent with the Phanerozoic galactic rotation period (250+/-50 Ma) and the solar system's cross-galactic

oscillation period (33+/-3 Ma). Further search for Precambrian impactite deposits and micrkrystite horizons and correlations between isotopic ages of impact signatures and Precambrian igneous units will be required to test potential relationships.
Author
Precambrian Period; Tectonics; Geochronology; Asteroid Collisions; Cometary Collisions; Hypervelocity Impact; Earth Crust; Earth Mantle

20000031441 NASA Johnson Space Center, Houston, TX USA
Large-Scale Impact Cratering and Early Earth Evolution
Grieve, R. A. F., Geological Survey of Canada, Canada; Cintala, M. J., NASA Johnson Space Center, USA; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 18-19; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The surface of the Moon attests to the importance of large-scale impact in its early crustal evolution. Previous models of the effects of a massive bombardment on terrestrial crustal evolution have relied on analogies with the Moon, with allowances for the presence of water and a thinner lithosphere. It is now apparent that strict lunar-terrestrial analogies are incorrect because of the ”differential scaling” of crater dimensions and melt volumes with event size and planetary gravity. Impact melt volumes and ”ancient cavity dimensions for specific impacts were modeled according to previous procedures. In the terrestrial case, the melt volume (V(sub m)) exceeds that of the transient cavity (V(sub tc)) at diameters is greater than or = 400 km. This condition is reached on the Moon only with transient cavity diameters is greater than or = 3000 km, equivalent to whole Moon melting. The melt volumes in these large impact events are minimum estimates, since, at these sizes, the higher temperature of the target rocks at depth will increase melt production. Using the modification-scaling relation of Croft, a transient cavity diameter of about 400 km in the terrestrial environment corresponds to an expected final impact ”basin” diameter of about 900 km. Such a ”basin” would be comparable in dimensions to the lunar basin Orientale. This 900-km ”basin” on the early Earth, however, would not have had the appearance of Orientale. It would have been essentially a melt pool, and, morphologically, would have had more in common with the palimpsests structures on Callisto and Ganymede. With the terrestrial equivalents to the large multiring basins of the Moon being manifested as muted palimpsest-like structures filled with impact melt, it is unlikely they played a role in establishing the freeboard on the early Earth. The composition of the massive impact melt sheets (> 10 (exp 7) cu km) produced in ”basin-forming” events on the early Earth would have most likely ranged from basaltic to more mafic for the largest impacts, where the melt volume would have reached well into the mantle. Any contribution from adiabatic melting or shock heating of the asthenosphere would have had similar mafic compositions. The depth of the melt sheets is unknown but would have been in the multilkilometer range. Bodies of basaltic melt is greater than or = 300 m thick differentiate in the terrestrial environment, with the degree of differentiation being a function of the thickness of the body. We therefore expect that these thick, closed-system melt pools would have differentiated into an ultramafic-mafic base and felsic top. If only 10% of the impact melt produced in a single event creating a 400-km diameter transient cavity evolved into felsic differentiates, they would be comparable in volume to the Columbia River basalts. It has been estimated that at least 200 impact events of this size or larger occurred on the early Earth during a period of heavy bombardment. We speculate that these massive differentiated melt sheets may have had a role in the formation of the initial felsic component of the Earth’s crust. Additional information is contained in the original.
Author
Earth Crust; Earth Surface; Impact Melts; Meteoritic Damage; Lunar Crust; Lunar Craters; Geomorphology; Meteorite Collisions

20000031442 Oslo Univ., Dept. of Geology, Norway
Geophysical Modeling of the Mjolnir Impact Structure, Barents Sea
Gudlaugsson, S. T., Oslo Univ., Norway; Tsikalas, F., Oslo Univ., Norway; Eldholm, O., Oslo Univ., Norway; Faleide, J. I., Oslo Univ., Norway; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 19; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Gravity, magnetic, and seismic traveltime anomalies observed at the 40-km-diameter Mjolnir impact structure reveal a distinct spatial correspondence with the radially zoned seismic structure. The gravity anomaly is dominated by a 2.5-mGal, 1 4-km-wide, centrally located high superimposed on a 45-km-diameter low with minimum values of-1.5 mGal. The magnetic anomaly field exhibits several local, low-amplitude anomalies in the +/-100 nT range toward the periphery, while seismic mapping of a prominent, originally planar reflector beneath the structure reveals a central pull-up traveltime anomaly on the order of 80 ms. In terms of impact origin, the integrated geophysical modeling based on the characteristic bowl-shaped seismic disturbance beneath the structure supports the differentiation into a central uplift and peripheral region. Interaction of several impact cratering processes, such as impact-induced porosity increase due to brecciation, mass transport during collapse, and structural uplift, explains the modeled physical properties associated with the disturbance. The modeling further substantiates the interpretation

of the Mjolnir Structure as an impact crater and demonstrates the incompatibility of alternative geological origins such as salt or clay diapirism and igneous intrusions. We find that integrated geophysical modeling of this type is a powerful tool for discriminating impact craters from similar features of different origin.
Author
Geology; Geophysics; Gravity Anomalies; Magnetic Anomalies; Models; Meteorite Craters; Impact Damage; Projectile Cratering

20000031443 Royal Inst. of Tech., Dept.of Geodesy and Photogrammetry, Stockholm, Sweden
Magnetic Anomalies of the Vredefort Central Rise Structure
Henkel, H., Royal Inst. of Tech., Sweden; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 19; In English; See also 20000031409; No Copyright; Abstract Only; Avail. from CASI only as part of the entire parent document

The specific magnetization of an impact structure is related to the potential of new coercive mineral phases being created as a result of the impact event and the possibility of these phases becoming thermally overprinted with a new remanence. Such magnetizations will acquire the direction of the then ambient geomagnetic field. The amount of these remagnetized carrier phases and the volume of their host rocks, together with the direction of the remanence and that of the present geomagnetic field, will determine the amplitude and shape of any associated magnetic anomalies. The processes that, taken together, create the magnetic patterns are usually complex. Two types of patterns have been found to be common to the several impact craters studied. They are related to impact melt bodies on the one hand and to thermal overprinting of basement structures on the other. In both cases, remanent magnetizations (residing in the highly coercive carrier phases), as well as the always-present induced magnetization (residing in the low coercive carrier phases), might be involved. Large, strongly magnetic melt bodies are, for example, known from the Mien and Dellen craters, while the large melt body of the crater Lappajarvi is low in magnetization. Thermal overprinting is not as well documented. Two aspects of thermal overprinting can be discerned from known cases. One is the hydrothermal change of high-magnetic carrier phases to low-magnetic phases (like the oxidation of magnetite to hematite), which creates a low-magnetic anomaly as seen in craters like Clearwater or Tvaren. The other is an additional remagnetization when the remaining thermal energy results in sufficiently high temperatures to imprint a new magnetization onto coercive carrier phases. The Vredefort central rise region displays the effects of a high temperature regime that has remagnetized all potentially coercive carrier phases. This occurred after the creation of the rise structure, thereby forming a new, partly discordant magnetic pattern. The extent of this overprinting is related to the temperature distribution cutting through the impact-created geometries of the collapse flow, but is still dependent on the shape of these structures within the thermal region. The extent of the magnetically active thermal region is related to the Curie temperatures of the carrier phases (ranging from 700 to 250 C). This remagnetization is frozen in as remanence, still the dominant magnetization, in a direction opposed to the present local geomagnetic field. The direction of this remanence was determined by Jackson and has, with magnetic data presented by Henkel and Reimold, been applied to magnetic modeling. This modeling shows that the observed magnetic anomaly pattern can be reproduced with a 1-4-km-thick, remanent-magnetized layer. The deeper part of this overprinted magnetic structure is to the northwest of the center, shallowing toward the southeast. This is interpreted as a later tilt and, consequently, oblique erosion of the structure, thus exposing a relatively deeper part of the central rise to the northwest. The issue of the so-called shock magnetization (i.e., remagnetization caused by the shock-wave passage) is illusive, since subsequent chemical and thermal processes totally dominate in potential remagnetizations. The creation of more coercive carrier phases may, however, be directly related to shock metamorphism, thus conditioning the affected rock masses for subsequent magnetic overprinting.
Author
Geomagnetism; Magnetic Anomalies; Magnetization; Meteorite Craters; Meteoritic Damage

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NBCS: the Baltic-Nordic Network for Impact Crater Studies
Henkel, H., Royal Inst. of Tech., Sweden; Reimold, W. U., Witwatersrand Univ., South Africa; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 20; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Baltic-Nordic Network for Impact Crater Studies, established in 1995, constitutes a cooperation between eight university departments in geosciences in Nordic (Iceland, Denmark, Norway, Sweden, and Finland) and Baltic (Estonia, Latvia, and Lithuania) countries. It is financially supported by the Nordic Academy for Advanced Study (NorFa), a body of the Nordic Council of Ministers. The network was created to promote impact crater studies in each of these countries through combined educational and research efforts. There are 16 known and 10 suspected impact structures in the Baltic-Nordic region. The region is accessible for field studies via an extended infrastructure, and detailed geophysical and geological data are available through national geological surveys. The region thus has all the prerequisites for research activity in impact geology. NorFa supports

research students by financing courses, workshops, and symposia. This support includes travel and living costs for participating students. The network's first activity will be a 10day workshop at the Dellen Crater and will include morning lectures and afternoon field observations. The workshop will focus on impact petrography, geophysics, and stratigraphy. Instructors and scientists have been invited from Stockholm and St. Petersburg. In the next two years, similar workshops will be held at the Gardnos Crater in Norway, with a focus on shock mineralogy, and at the Kaali crater field, with a focus on postglacial craters. Author

Geophysics; Organizations; Scandinavia; Meteorite Craters

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Combined Geophysical Modeling of the Vredefort Structure

Henkel, H., Royal Inst. of Tech., Sweden; Reimold, W. U., Witwatersrand Univ., South Africa; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 20; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Modeling of gravity data for the region of the Vredefort Structure was done by integrating seismic and petrophysical measurements using the principle of mutually complementary and constraining data The procedure for the integrated modeling is described in detail and includes six steps: (1) A background crustal model was derived from refraction seismic data; (2) a conversion of p-wave velocities to densities using the relations in Durrheim; and Green was made for all deep crustal structures; (3) the known surface geology was kept constant in the modeling process; (4) densities of surface rocks derived from Smit and Maree and Stepto were used to calculate formation averages for the supracrustal strata; (5) the northwest basin depth was constrained by reflection seismic data from Durrheim; and (6) the free segments of the subsurface structures were adjusted until the calculated gravity effect equaled the measured effects (within measurement errors). The resulting gravity models, along northwest-southeast and south-southwest-north-northeast profiles intersecting near the center of the Vredefort Dome, describe the likely present structure of the Vredefort crater. The impact-related basin in the Vredefort Dome area has a diameter of 250 km, preserved in the present south-southwest-north-northeast extension of the structural Witwatersrand basin, and depths ranging from 7 km in the southeast to 12 km in the northwest and north. The remaining structural uplift in the center is 12 km. Postimpact deformation, as indicated by the asymmetry of the structure, includes tilting (with the southeastern part uptilted), which is responsible for the present asymmetric shape of the central rise (Vredefort Dome), and northwest-southeast shortening of the impact basin by as much as 85 km. This was probably caused by thrusting from the northwest and major flexing in the southeast. The shape of the crystalline central rise structure is hyperbolic in section, with a diameter of 70 km at its base, 35 km at the middle, and 40 km at the present erosion surface. Around its southwestern, western, northwestern, and northern perimeter, the surrounding cover sequences are overturned. This is not the case along the eastern and southeastern perimeter, where the structure is at a deeper erosion level. The upper-lower crustal interface was raised 9 km and occurs now at 16 km depth. The crust-mantle interface was only slightly involved, with a potential rise of about 4 km vaguely indicated by the rise of the deepest seismic reflectors under the northwest basin. The whole crust is, thus, not on edge, as has been previously postulated, and there is no connection between observed mafic rocks at the surface and the upper mantle as asserted by Hart.

Author

Crusts; Geology; Gravitation; Mathematical Models; Meteoritic Damage; Meteorite Craters; Projectile Cratering; Topography

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Reconstruction of the Vredefort Impact Crater

Henkel, H., Royal Inst. of Tech., Sweden; Reimold, W. U., Witwatersrand Univ., South Africa; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 20-21; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

For the reconstruction of an impact crater, information is needed about crustal structure and conditions at the time of impact and about the properties of the projectile. This information can be deduced from the present deformed and eroded status of impact structures only to a very limited degree. The keys to the crustal structure are provided by regional geology and refraction seismic sections. The present shape of the structure can then be assessed through geophysical modeling using gravity and magnetic data. The central rise feature in large craters will remain even at deep erosion levels and is thus key to determining the position and potential extension of the former crater. In the Vredefort Structure, the preimpact cover thickness has been estimated to be about 15 km and the gravity model shows a well preserved central rise with remaining stratigraphic uplift of about 12 km. The parameters of the projectile can only be vaguely assessed by the extent of shock deformation, occurrence of melt bodies, and other shock-induced changes of the crust. The extent of shock deformation in the near range of the explosion is obscured by the subsequent crater collapse. In the far range, the change of rocks from their normal (with respect to composition and position in the crust) rheologic behavior to the shock-induced plastic behavior above their Hugoniot Elastic Limit (HEL) is indicated by the

onset of reflection seismic transparency at -70 km from the explosion center (in those parts of the crater basement that are least deformed by subsequent collapse processes). Using the estimate of the HEL position, assumptions can be made about the energy of the projectile and thus the potential range of melt volumes . Such melt has so far only been identified as dikes in the central rise crystalline core. Its chemical composition indicates an intermediate source, and its position within the low density crust of the uppermost crystalline basement in the core of the central rise indicates that the shock melting did not occur at deep levels in the basement. The excavation flow roughly follows a pattern described as the z-model in Melosh, implying vertical-downward-directed flow beneath the explosion center injecting and displacing material, and upward-outward-directed flow where ejecta leave the evolving crater at about 45 deg angles. It is supposed that this mass-transport pattern conditions the crust for subsequent collapse flow. Whereas the transient crater edge will flow into the crater, the central rise will collapse vertically downward and flow radially outward. The two will collide at some distance from the center, resulting in the final crater, extended by almost a factor of two in diameter and leaving a raised rim, a mega-breccia-filled ring basin, and a central rise overturned in its upper parts. The energy deposited by the shock wave now resides as heat in the newly formed crater, adding to the elevated temperatures brought in by the central rise from deeper crustal levels. This new temperature regime within a brecciated environment represents a huge potential for hydrothermal processes, leaching, transporting, and precipitating various chemical components. The remaining topography of the collapsed impact crater will be leveled by erosion and sedimentary infilling. Younger deformation events might reshape the structure. The Vredefort Structure was affected by both tilting (northwest up), faulting or flexing (southeast up), and thrusting (northwest in), so that the present shape of the impact structure is an elongated basin, roughly representing the original extent of the crater only in its southwest-northeast direction. Young cover rocks obscure most of the south and southeast of the structure.
Author
Geophysics; Meteorite Craters; Cratering; Impact Damage; Topography; Geomorphology; Meteoritic Damage

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Origin of Carbonaceous Matter in Rocks from the Whitewater Group of the Sudbury Structure
Heymann, D., Rice Univ., USA; Dressler, B. O., Lunar and Planetary Inst., USA; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 21; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

It has long been known that heterolithic breccias of the Black member of the Onaping Formation and mudstones of the Onwatin Formation, both formations belonging to the Whitewater Group, contain about 1% carbonaceous matter. Crucial observations show that this large C content is wholly contained within the Sudbury basin and that the C content of the Onaping's Gray member (which, like the Black member, is supposed to be a fallback breccia from the impact) is an order of magnitude smaller. The anthraxolite veins in the Onwatin are thought to consist of the same C that was mobilized. Among the hypotheses that have been set forth for the origin of the C are (1) the reduction of gases during fumarolic activity; (2) C from the impactor; (3) the transformation of CO to CO2 + C in the cooling atmospheric impact plume; and (4) a biogenetic origin. Each of these hypotheses has its own problems.Biogenetic processes do not form carbonaceous matter such as is present in the Whitewater Group rocks, but rather produce organic matter with O, N, S, and H still banded to it. It is generally thought that a metamorphic heating event is required to strip the O, N, S, and H from the organic remains to form carbonaceous matter, and it is known that metamorphic conditions can be deduced from the Raman spectra of the C that is formed. The Raman spectrum of single-crystal graphite has one first-order line at 1580 cm(sup -1) (G-line). A forbidden line at 1360 cm(sup -1) (D-line) appears in the spectra of disordered graphite. The intensity ratio D/G serves as a rough indicator of grain size or degree of disorder. Carbonaceous matter formed from organic remains during greenschist-facies metamorphism has roughly equally intense G-lines and D-lines. We have obtained Raman spectra for nine Black Onaping (BO) samples and one Onwatin sample and for anthraxolite taken from near the Errington I mine. The BO rocks came from High Falls, Chelmsford, Capreol, Nickel Offset Road, and Nelson Lake collection sites. All spectra had nearly equally intense G-lines and D-lines. When these results are combined with C isotopic data (Sigma(exp 13)C of -31.06%, -30.10%, and -30.24% respectively) for two BO and one Onwatin rocks, for an anthraxolite (Sigma(exp 13)C of -31.5% from Lot 10, Concession 1, Balfour Township, and the presence of algal relics in an Onwatin rock, the biogenetic hypothesis for the origin of the carbonaceous matter in the Onaping and Onwatin Formations becomes the leading contender. Its major problem has been one of timing. The Black member is thought to have sedimented rapidly and soon after the deposition of the Gray member. How rapidly and how soon, however, cannot be ascertained with any great precision, and algal blooms, given the extant conditions (warm waters, ample nutrients, and a CO2-rich atmosphere), could have been super-fast, with the appearance of fresh crops at the surface keeping pace with the burial of older crops beneath the growing thickness of the Onwatin package. The in situ biogenetic hypothesis has the additional forte of demanding that the formation of the carbonaceous matter took place entirely within the Sudbury basin. The impactor- and CO-based hypotheses cannot be totally dismissed, however. The Raman

spectra of C in the Allende meteorite are very similar to those obtained for the Onaping and Onwatin rocks, as is the Raman spectrum of a heavily shocked graphite (both obtained in the present study).
Author
Carbonaceous Rocks; Meteoritic Composition; Carbonaceous Meteorites; Carbon; Meteorite Craters

20000031448 Rice Univ., Dept. of Geology, Houston, TX USA
Carbon Isotopic Composition of Carbonaceous Matter in Rocks from the Whitewater Group of the Sudbury Structure
Heymann, D., Rice Univ., USA; Dressler, B. O., Lunar and Planetary Inst., USA; Dunbar, R. B., Rice Univ., USA; Mucciarone, D. A., Rice Univ., USA; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 22; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The origin of carbonaceous matter in the heterolithic breccias of the Black member of the Onaping Formation and in mudstones of the Onwatin Formation has long been an enigma. Avermann was the first to propose a biogenetic origin, based on the fact that the delta-13-values of the carbonaceous matter from two samples of the Black member of the Onaping Formation and one of the Onwatin Formation were all close to -30%, which is at the lower end of the range of nonmarine plants and animals. Avermann also found relics of algae in an Onwatin slate and concluded that the carbonaceous material had originated from biogenetic material deposited at a slow rate into a local euxinie basin created by the Sudbury event. However, for the biogenetic material to become carbonaceous matter, it had to undergo graphitization associated with the greenschist-facies metamorphic history of the host rocks. Elsewhere in this volume, it is reported that the Raman spectra of the carbonaceous matter are fully consistent with such a metamorphic history. The only other delta-13 value (-31.5%) of carbonaceous matter from the Whitewater group is that of an anthraxolite. Because of the comparatively small number of data available, it seemed useful to do a more comprehensive survey of C isotopic compositions of carbonaceous matter in samples obtained from various geographic locations within the Sudbury Structure. The powdered rocks were first treated with toluene and then with methanol to remove soluble organic compounds. All powders were treated with HCl to dissolve any carbonate. Sulfides such as pyrrhotite were also dissolved in this step, but some elemental S was formed. Several delta-13 measurements were done with such wholerock samples. A number of samples were demineralized with HFHCl, and the dried C-enriched residues were used for delta-13 measurements. Carbon dioxide for the mass-spectrometric analysis was generated by flash combustion in 0 2. In the Carlo-Erba NA1500 elemental analyzer that was used, N oxides were reduced to N 2 and the separation of CO2, N2, H2O and SO2 which were carried along in a stream of He carrier gas, was achieved with a gaschromatographic column Typically, 0.2 mg of C was converted to CO, The mass spectrometer used in this study was a semi-automated VG 602E. The performance of the instrument was tested with NBS21 and Sulfanilamide CHNS standards. These results strongly support a biogenetic origin for the Sudbury C. However, it is still unknown exactly what organisms were involved and at what rate the Black Onaping Formation accumulated. The observation that the C content of that formation increases from base to top suggests that the sedimentation rate slowed over time. Additional information is contained in the original (Table).
Author
Carbon; Carbonaceous Rocks; Carbon Isotopes; Carbonaceous Meteorites; Exobiology; Meteoritic Composition

20000031449 Rice Univ., Dept. of Geology and Geophysics, Houston, TX USA
Origin of Native Sulfur in Rocks from the Sudbury Structure, Ontario, Canada
Heymann, D., Rice Univ., USA; Dressler, B. O., Lunar and Planetary Inst., USA; Thiemens, M. H., California Univ., San Diego, USA; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 23; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

When native S was discovered in the heterolithic breccias of the Black member of the Onaping Formation, the question of its possible impact origin arose. In addition to the native S (S(sup O)) content, we determined the total C and total S contents in several Whitewater Group rocks. We also examined the S(sup O) content associated with pyrrhotite to determine if S(sup O) is a product of pyrrhotite weathering. In the weathered crust of a block of massive pyrrhotite from the Whistle Mine, S(sup O) was 29.4 ppm; in pyrrhotite 0-5 mm below this crust S(sup O) was 4.4 ppm; and at about 10 cm below the surface, S(sup O) was undetectably small. The S(sup O) content of this finely powdered pyrrhotite after exposure to water for 10 days became 1.0%. The S(sup O) content in a pyrrhotite separate from rock SUBD4 was 1.4% on the basis of this evidence, it is concluded that the native S in these rocks was formed by weathering of pyrrhotite and not related to the impact origin of the Sudbury Structure. Furthermore, an impact origin of S(sup O) is unlikely, because it probably would not have survived the postimpact greenschist facies metamorphism. The isotopic composition of S was determined in three samples, including a pair of pyrrhotite and S extracted from it and a sample of S extracted from rock SUBD4. The delta-34 S values of the pyrrhotite/S pair are within the range of data reported. For samples with perfect mass-dependent fractionation, both D33 and D36 are zero. Obviously there is a component of mass-independent fractionation present, but its origin is not understood. The isotopic composition of S(sup O) from

SUBD4 strengthens the conclusion that native S did not come from an extraterrestrial biogenetic source. Additional information is contained in the original (2 Tables).
Author
Pyrrhotite; Sulfur; Sulfur Isotopes; Meteoritic Composition; Isotope Ratios; Meteorite Craters

20000031450 Rice Univ., Dept. of Geology and Geophysics, Houston, TX USA
The Search for Fullerenes in Rocks from the Whitewater Group of the Sudbury Structure, Ontario, Canada
Heymann, D., Rice Univ., USA; Buseck, P. R., Arizona State Univ., USA; Knell, J., Arizona State Univ., USA; Dressler, B. O., Lunar and Planetary Inst., USA; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 23; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The occurrence of fullerenes C(sub 60) and C(sub 70) in heterolithic impact breccias of the Black member of the Onaping Formation was reported by Becker et al. The authors assumed that the fullerenes had formed in the atmospheric impact plume, possibly by the pyrolysis of polycyclic aromatic hydrocarbons (PAHs) of the impactor, but did not explain the high content of carbonaceous matter in these breccias. In 1996, Becker et al. reported the occurrence of fullerenes with isotopically anomalous He trapped inside the C cages and concluded that the impactor must have contained extraterrestrial fullerenes. The C(sub 60) contents of these rocks were reported as 1-10 ppm. Because of the interesting implications of both findings, it was decided to expand the search for fullerenes in rocks from the Gray and Black members of the Onaping Formation and one C-rich mudstone sample from the Onwatin Formation. The total C and S contents of these 22 rocks are reported in a companion abstract. Fullerenes were searched for by high-performance liquid chromatography in powdered bulk samples of 21 of these rocks (SUB8 was the exception). Typically 100 g of SURG, SUBD, and SUGJ and 10-20 g of SUBF rocks were analyzed. Duplicate measurements were performed in 11 cases and fullerenes were searched for in five HCL-HF demineralized C-rich residues. No fullerenes were detected. A parallel search for fullerenes was conducted in three rocks by mass spectrometry. One of these rocks, SUBF8, had been collected from the same High Falls outcrop as one of the samples of Becker et al. No fullerenes were found. If fullerenes occur in the Black member of the Onaping Formation at all, that formation would hardly be ”one of the largest natural occurrences of fullerenes found so far on Earth”, because the distribution of these molecules is obviously very heterogeneous, with most of the rocks containing no fullerenes. The difficulties inherent in the original hypothesis were spelled out by the authors and hence need not be repeated here. The problems with the extraterrestrial hypothesis are as follows: Because C(sub 60) and C(sub 70) are more volatile than Ir and its compounds, and Ir from the analogous Chicxulub event was deposited worldwide, one expects the ”Sudbury impactor fullerenes” to have become distributed, if not globally, then at least over a much wider area than the Sudbury basin. Unfortunately, because the pre-erosion mass of the C(sub 60)-bearing rocks at Sudbury is unknown, it is impossible to estimate how much fullerenes the impactor had to contain to account for the known finds However, the C(sub 60) contents of the rocks that contain it normalized to C, are in the range 101-101 ppm, some 3-4 orders of magnitude larger than reported for a carbonaceous chondrite. Like the suggested terrestrial fullerenes, the extraterrestrial fullerenes had to be shielded from destruction in the hot plume, in the hot fallback breccias, and during postimpact greenschist-facies metamorphism. It is unclear how incorporation into sulfides might protect the fullerenes. If a C(sub 60)-bearing Black member sample were exposed to temperatures of greenschist metamorphism, it would be useful to study the probability of fullerene survival at these temperatures.
Author
Breccia; Fullerenes; Carbon; Meteoritic Composition; Meteorite Craters

20000031451 Geological Survey of Canada, Ottawa, Ontario Canada
The Steen River Impact Structure, Alberta, Canada
Hildebrand, A. R., Geological Survey of Canada, Canada; Pilkington, M., Geological Survey of Canada, Canada; Grieve, R. A. F., Geological Survey of Canada, Canada; Stewart, R. R., Calgary Univ., Canada; Mazur, M. J., Calgary Univ., Canada; Hladiuk, D. W., Gulf Canada Resources Ltd., Canada; Sinnott, D., Gulf Canada Resources Ltd., Canada; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 23-24; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The approximately 25-km-diameter Steen River impact structure (59 deg 30 sec N, 117 Deg 38 sec W) is the remnant of the largest known impact crater in the Western Canadian Sedimentary Basin (WCSB). The eroded crater lies buried under approximately 200 m of cover with no surface expression, necessitating geophysical and drilling projects for its exploration. In this area, the WCSB is composed of about 1 km-thick, gently southwest-dipping strata. The crater rim hosts seasonal petroleum production of 600 barrels of oil per day (BOPD) and shut-in gas wells, stimulating continued searches for hydrocarbon reservoirs in the impact structure. Although Steen River was discovered more than 30 years ago with documented evidence of shock metamorphism, little has been published about it. Hydrocarbon exploration companies have acquired more than 100 two-dimensional seismic reflection profiles over the impact structure; in addition, one three-dimensional seismic survey was

recently executed over part of the crater rim. Approximately 40 wells have been drilled in and near the crater, providing generally good control for the coherent seismic data. The proprietary seismic data outline the rim uplift of the impact structure in some detail, but most profiles record only chaotic reflectors interior to this. Mapping the crater's interior structures has been attempted with magnetic- and gravity-field surveys. An aeromagnetic survey with 0.5-km line spacing has recently been flown across the entire structure, revealing large-amplitude central and concentric anomalies. A pilot gravity survey revealed associated anomalies with a maximum value of about 3 mGal, slightly smaller than that expected for a crater of this size. Positive anomalies of up to 4.5 mGal were found associated with the rim uplift. A total of about 1500 gravity stations have now been acquired over the crater. Interpretation of the gravity data is complicated by the high regional gradients (17 mGal decreasing to the northwest across the impact structure), with superimposed regional anomalies of 10-20 km scale. Rim uplift, down-slumped blocks and central uplift are well to partly delineated. Well 16-19 records the inverted stratigraphy of the overturned flap, lying on the inner down-slumped blocks, and establishes a minimum structural downdrop of 4.6 km. Only minor relief is indicated on the unconformity developed on the top of the impact lithologies. Rim erosion of about 1 km is indicated by the amount of extra stratigraphy preserved in the slumped blocks in well 16-19 in the crater's interior and by the assumption of a rim-to-crater-floor depth of 0.5 km. This erosion has presumably subdued the crater's gravity expression. Reflection seismic data usually have not detected the down-slumped blocks but occasionally provide vague images, and a slump zone at least 3 km wide is indicated. Wells and seismic profiles reveal an irregular, faulted crater perimeter with rim uplift of up to about 100 m. The central structural uplift has a radius of about 3 km, based on well control and magnetic-field anomalies; substantial asymmetry may occur in the central uplift and slump zone. Well 12-19 penetrated the central structural uplift immediately below the Cretaceous cover at a depth of 194 m, establishing a minimum structural uplift of about 1100 m relative to the surrounding basement surface. Large-amplitude magnetic anomalies are also preserved adjacent to and detached from the central uplift; these may represent remnants of intracrater melt rocks and/or suevitic breccias. Additional information is contained in the original.

Author

Meteorite Craters; Impact Damage; Descriptions; Projectile Cratering; Ejecta; Meteoritic Damage

20000031452 Geological Survey of Canada, Ottawa, Ontario Canada

Mapping the Chicxulub Crater Structure with Gravity and Seismic Relfection Data

Hildebrand, A. R., Geological Survey of Canada, Canada; Pilkington, M., Geological Survey of Canada, Canada; Halpenny J. F., Geomatics Canada, Canada; Cooper, R. V., Geomatics Canada, Canada; Connors, M., Athabasca Univ., Canada; Oritiz-Aleman, C., Ciudad Univ., Mexico; Urrutia-Fucugauchi, J., Ciudad Univ., Mexico; Graniel-Castro, E., Universidad Autonoma de yucatan, Mexico; Camara-Zi, A., Universidad Autonoma de yucatan, Mexico; Buffler, R. T., Texas Univ., USA; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 24-25; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Chicxulub Crater, buried under the Yucatan Platform of Mexico, affords one of the most favorable opportunities on Earth for structural studies of a large complex impact crater, primarily because of its preservation and accessibility. The crater was buried soon after rim erosion in an environment that sustained only minor subsequent tectonic disturbance In addition, the Chicxulub impact apparently ended the Cretaceous period, and the crater's ejecta blanket is known globally at hundreds of locations. The buried crater is half overlain by a coastal plain and half by a shallow sea, allowing exploration by marine-based, land-based, and hybrid techniques. The radial symmetry of the crater allows data acquired in either terrain to be applied to the entire structure using the common datasets of magnetic- and gravity-field anomalies. Gravity datasets covering the Yucatan Platform reveal an about 180-km-diameter low with an internal concentric structure that is the expression of the Chicxulub Crater impact lithologies and crater fill. The gravity signature is complicated by regional anomalies and early modifications to the crater rim, and the northern half of the crater is not well imaged because of the scarcity and imprecision of marine data. Also, an about 20-km-wide gap in survey coverage (due to shallow water) occurs between the land data and the nearest seismic profile of Camargo and Suarez, which roughly corresponds to the beginning of offshore coverage. In September-October 1996, a marine gravity survey was successively conducted on 32-m and 10.5-m vessels to survey this gap and offshore seismic lines of the Imperial College/British Institutions Reflection Profiling Syndicate/University of Texas seismic project. Offshore coverage was about 2400 line-km, followed by about1500 line-km inshore with about 1.3 and about 1.9 mGal unadjusted crossovers, respectively; data precision was strongly influenced by sea conditions. Preliminary results from the marine surveys confirm the provisional ties of gravity-gradient features to the seismic line. The perimeter fault, crater-fill margin, slump faults, and collapsed transient cavity margin may all be linked to gradient features. Unfortunately, the clearest crater expression in the gravity field is on the east side, where the seismic lines lose resolution at the basin margin. to the west, the strong peripheral gradient splits with one component corresponding to the perimeter slump fault and a larger feature corresponding to the basin margin. This splitting is interpreted as a result of the prompt backwash of crater ejecta into the northwestern pan of the crater. Regional gradients also obscure the crater signature to a greater extent to the west. Asymmetry of the central high is indicated, although a weak feature may extend to the northeast; the surrounding

sharp low continues until it abuts the regional high to the northwest. Additional land surveys support the correlation of the cenote ring to gravity-gradient features and suggest that a weak high may correlate to the rim uplift in some places. Additional information is contained in the original.
Author
Ejecta; Gravitational Fields; Meteorite Craters; Gravity Anomalies; Projectile Cratering; Meteoritic Damage

20000031453 Muenster Univ., Institut fuer Planetologie, Germany
Geochemical Characteristics of Impactites from the Popigai Impact Structure, Russia
Hoelker, Th., Muenster Univ., Germany; Deutsch, A., Muenster Univ., Germany; Masaitis, V. L., Karpinsky Geological Research Inst., USSR; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 25; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The 100-km Popigai impact structure, situated on the northeastern slope of the Anbar Shield, Northern Siberia (N 71 deg 30 sec, E 111 deg 0 sec), is known for its excellent state of preservation. The most precise published age (Ar-40 - Ar-39) of 35.7 +/- 5 Ma., indicates an origin in the Late Eocene. This crater has been suggested as a possible source of shocked quartz in an Ir enriched ejecta horizon in the Massignano section, Italy. We report SR and Nd isotope characteristics and rare earth element (REE) distribution patterns of tagamites, impact glasses, and target rocks from Popigai. These data exclude Popigai as a parent crater of the hitherto-analyzed, Late Eocene distant ejecta horizons. We have analyzed whole-rock samples from the Popigai Crater for Nd-SR isotope signatures and REE concentrations. The samples are (1) variably shocked gneissic target rocks from the ring uplift (garnet gneiss #1320/65), the crater rim (plagiogneiss #132a), and a suevite (garnet-biotite gneiss inclusion #7232a); (2) a tagamite (# 1284/91.9); and (3) impact melt glasses, separated from various breccias (specimen #8-78/7, 6459d, 8-616, 4602/88-89, 8-620, 4602/36). The total REE abundance of the tagamite and the melt glasses is high, lying between 216 and 229 ppm. The impact melt lithologies display quite uniform, chondrite-normalized (cn) distribution patterns (Fig. 1) with a distinct negative Eu anomaly (Eu(sub cn)/Eu(sub cn)* = 0.54-0.63) and strong LREE enrichment with LA(sub cn)/Yb(sub cn) between 8.74 and 10.08. The REE distribution patterns of the melt samples differ significantly from those of the gneissic samples from the crater rim and the ring uplift, whereas gneiss inclusion #7232a has REE abundances similar to the melt lithologies, except for slightly lower LREE. As described in another work, SR and Nd isotope parameters of the melt lithologies show only minor variations. T(sup SR) (sub Ur) is 2.07 +/- 0.05 Ga, T(sup ND) (sub CHUR) is 1.95 +/- 0.02 Ga, T(sup Nd) (sub Dm) is 2.21 +/- 0.02 Ga (n = 7 +/- 1(sub D)). The isotopic data and the close range in model ages could help to identify distant ejecta of the Popigai event and to separate such material from ejecta of the Chesapeake Bay impact structure. So far, none of the analyzed 35-Ma tektites, and microtektites display isotope characteristics such as the Popigai material, confirming the interpretation of Koeberl. Additional information is contained in the original.
Author
Ejecta; Geochemistry; Strontium Isotopes; Neodymium Isotopes; Meteorites; Meteoritic Composition

20000031454 Open Univ., Planetary Sciences Research Inst., Milton Keynes, UK
Diamonds in the Ejecta and Fireball Layers of the Cretaceous-Tertiary Boundary in the U.S. and Mexico
Hough, R. M., Open Univ., UK; Gilmour, I., Open Univ., UK; Pillinger, C. T., Open Univ., UK; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 26; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Cubic nanodiamonds ranging from 3 to 5 nm were first discovered in the K/T boundary fireball layer in the Knudsens' Farm area, Alberta, Canada. Gilmour et al. subsequently found diamonds measuring up to 6 nm in the fireball layers of the Berwind Canyon, Colorado, and Brownie Butte, Montana, K/T localities in the U.S. We have studied acid-resistant residues of fireball and ejecta layer samples from Berwind Canyon, Raton Pass, and Clear Creek North in the U.S. and also from Arroyo El Mimbral and Arroyo El Penon in Mexico. Transmission electron microscope (TEM) observations of the acid-resistant residue from the fireball layer of the Berwind Canyon locality identified a predominance of zircon and rutile, but cubic nanodiamonds up to 10 nm in size were also found. The nature of the acid-demineralization treatment mitigates the survival of less robust forms of C; therefore, any C released during stepped combustion of the sample represents combustion of either diamond or Si carbide. Transmission electron microscope (TEM) observations of the acid-resistant residue from the fireball layer of the Berwind Canyon locality identified a predominance of zircon and rutile, but cubic nanodiamonds up to 10 nm in size were also found. The nature of the acid-demineralization treatment mitigates the survival of less robust forms of C; therefore, any C released during stepped combustion of the sample represents combustion of either diamond or Si carbide. Using stepped combustion combined with static mass spectrometry, we have revealed carbonaceous components in both the ejecta and fireball layer samples from the U.S. locations. The acid-resistant residue of the fireball layer from Raton Pass, New Mexico, released 3.3% C in an experiment from 200 to 1200 C, with 77% of this coming from a single release between 425 and 575 C. The C isotopic composition delta C-13

of this release varied between -17% and -23%, indicative of multiple components. The ejecta layer residue from this site yielded 1.5% C in a similar experiment. of the C released, 83% was in a single pulse from 400 to 550 C. The delta C-13 varied from -18% to -22%, again indicating multiple components with values similar to those from the fireball layer. Similar results were obtained using the same experiments on acid-resistant residues from the Clear Creek North and Berwind Canyon localities in Colorado. Initial TEM observations indicate that the carbonaceous component in the ejecta layers is indeed diamond. The ejecta layer from the Clear Creek North locality revealed diamonds up to 20 nm in size, with d-spacings corresponding to cubic diamond. In the Mexican localities, the equivalents of the ejecta and fireball layers are the spherule bed and Ir-rich layer. We have studied acid-resistant residues of samples from both of these layers. The Ir-rich layer from Mimbral contained diamond aggregates up to 30 mm in size, and the residue of the spherule bed from Penon contained one grain identified as diamond with the TEM. Although this is preliminary work, the indication is that both the ejecta and fireball layers from K/T localities in the Western interior of the U.S. and the equivalent layers from Mimbral and Penon in Mexico contain diamonds. These diamonds are presumably impact-produced by shock and/or by condensation from the fireball, in a process similar to chemical vapor deposition. The C isotopic compositions of the diamonds indicate a mixed C source.
Author
Cretaceous-Tertiary Boundary; Meteoritic Diamonds; Ejecta; Meteoritic Composition; Carbonaceous Meteorites

20000031455 Academy of Sciences (USSR), Inst. for Dynamics of Geospheres, Moscow, USSR
Sudbury Impact Event: Cratering Mechanics and Thermal History
Ivanov, B. A., Academy of Sciences (USSR), USSR; Deutsch, A., Muenster Univ., Germany; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 26-27; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Sudbury Igneous Complex (SIC) is interpreted as the solidified impact melt body of the 1.850 Ga Sudbury impact structure. We present the first results of the numerical modeling of the impact cratering process and the thermal evolution model for this about 250-km multiring structure. to produce the estimated volume (about 8000 cubic km) of the impact melt, one needs to have a spherical projectile of 14 km in diameter at impact velocity of 20 km/second. Cooling of the impact melt sheet from the initial temperature of 2000K below liquidus at 1450K lasted about 100 k.y.; below the solidus at 1300K cooling lasted about 350 k.y. Impact Modeling: We simulated numerically the vertical impact of a stony (granite) body at the granite target at the impact velocity of 20 km /s. The SALE hydrocode was modified to handle multimaterial problems with an elastic-plastic description for solids. The projectile diameter varied from 10 to 15 km for a cylinder with a height equal to its radius. to fit the volume of melt (8000 cubic km) estimated by Grieve and Cintala, one needs to assume a Sudbury projectile of 12.5 km in diameter (or an equivalent spherical projectile of 14 km diameter). Depending on the projectile size, the transient cavity reached a depth of 40-50 km and an excavation radius of 50-60 km. The final crater shape and size would strongly depend on the supposed rheology. With an account to the acoustic fluidization, the final diameter is estimated at 200-250 km. The depth of the melting zone is estimated at 35 km, which is less than the present crust-mantle boundary at the Sudbury site (40 km according to Braile et al.). The mantle uplift during the transient crater collapse depends on the assumed rheology and varies from 0 to 25 km. Our simulation allows us to estimate the temperature field beneath the melt layer just at the end of the modification stage. Thermal Modeling: We made simple estimates (one-dimensional implicit numerical code) to evaluate the cooling history of the SIC body. The geometrical constraints of the model are three flat layers: (1) an overburden material with a thickness of 2.5 km, resting on (2) a 2.5-km-thick melted layer, which in turn is underlain by (3) rocks of the lower crust, uplifted above preimpact level according to the aforementioned numerical simulations. The surface boundary conditions of layer (1) are held constant at a temperature of 300K, temperatures within layer (1) range from 300K (”cold breecia”) to 850K (”hot suevite”). The melt layer (2) has an initial temperature of 1800-2000K For layer (3), a constant temperature of 500-800K was assumed (in accordance with numerical simulations described above) from the interface with the SIC down to the ”undisturbed” depth. Thermal constants used in our calculations were the same as those used for thermal modeling of the Manicouagan Crater. We obtained the following results for the impact melt layer of the Sudbury Structure: The time span needed for a decrease of the initial temperature below the liquidus point (assumed at 1450K) is about 100 k.y.; below the solidus point (assumed at 1300K), the time span is about 300 k.y. In contrast, this time span is only 1 k.y. for the 200-m-thick melt sheet of the Manicouagan structure. Our result simply reflects the [length](exp 2)/[time] scaling. A factor of 2 is assigned as minimum uncertainty to the solidification time of the SIC, due to uncertainties in thermal properties and boundary conditions. Two-dimensional or three-dimensional thermal modeling and convective heat transfer inside the melted body also can modify the numbers; however, the order of magnitude from our simple estimate will remain unchanged. Conclusion: The combination of hydrocode simulations together with thermal modeling creates a solid basis for comparisons with observational constraints.
Author
Cooling; Cratering; Impact Melts; Mathematical Models; Meteorites; Meteorite Craters; Thermal Analysis; Projectile Cratering

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Large Chemical Vapor Deposition Diamond-Like Carbon Formed by Multi-Impact Reactions

Kobayashi, H., Yamaguchi Univ., Japan; Miura, Y., Yamaguchi Univ., Japan; Fukuyama, S., Yamaguchi Univ., Japan; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 27-28; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Large diamond crystal is formed by static high pressure in terrestrial deep-seated crust and in synthetic materials. Microdiamond (known as low-pressure diamond) is formed by highspeed bombardments of electron or ion beams or plasma, a process known as Chemical Vapor Deposition (CVD), in a low-pressure atmosphere, but the microarea of beam bombardment is a dynamic high-pressure-by-impact process. The main purpose of this study is to analyze large CVD diamond-like C formed by multireactions of impact at the Barringer meteorite crater. U.S. High-pressure forms of stishovite and coesite silica minerals were found in the meteorite impact crater of Barringer, Arizona. The same high-pressure C of microdiamond was analyzed as cubic and hexagonal diamond-like C material. There are two types of diamond-like C from the Barringer Crater: (1) Iron meteorite contains a black vein with diamond-like C (as exhibited in the Crater Museum), and (2) a black block of mixed Fe and graphite contains Fe veins with diamond-like C. The second diamond-shaped C type is shocked graphite formed by impact on the crater. This is mainly because the black-graphite block contains the special graphite C, including (1) shocked graphite with high density and elements of Si and Ca and (2) main sources of Si and Ca from target rocks of sandstone and limestone on the Earth , not from asteroids. An impact origin for the graphite block is confirmed by the fact that (1) the Fe-metallic vein contains Si from sandstone and Ca from limestone on the target rock of the crater, and (2) the large graphite block contains fine Fe-metal mixed with Si or Ca. These analytical data indicate that the graphite block with CVD diamond-like C formed by impact on the target rocks of the Earth. The Fe-metallic vein mixed with Si and Ca contains graphite C of hexagonal and cubic-diamond shape, considered to be two types of diamonds. However, the diamond-like C grains were extracted by 6NHNO3 as cubo-octahedron, previously misinterpreted as two types of diamond shapes. The composition of grains of cubo-octahedron shape was confirmed by high-sensitive energy-dispersive X-ray scanning electron microscopy (ASEM) as C-rich material in this study. Extracted C is considered to be the same shape as CVD diamond formed by electron-, ion-, or plasma-beam bombardments. Plasma conditions are believed to be produced by a meteoritic impact event around the crater. In fact, vapor plumes of large size are formed in the center of impact site as plasma conditions. Similar plasma conditions are confirmed even in a small-size impact . A large size of CVD diamond-like C with cubo-octahedron is 50-70 micron in size, which is a few times larger than normal CVD diamond. A source of C is believed to be the limestone target rock. Conclusions on the large size and source of C require a formation model of multireactions of C within the vapor plume of impact site. The present conclusion of mixed growth as a multireaction within the crater is confirmed in artificial impact crater experiments with an Al metallic target (with -3-cm-diameter crater and wormy multireacted grains). (Additional information is contained in the original)

Author

Carbon; Metalorganic Chemical Vapor Deposition; Crystal Growth; Meteoritic Diamonds; Meteoritic Composition

20000031458 Wien Univ., Inst. of Geochemistry, Austria

The Jurassic-Cretaceous Boundary Impact Event: The Morokweng Impact Structure, South Africa

Koeberl, C., Wien Univ., Austria; Reimold, W. U., Witwatersrand Univ., South Africa; Armstrong, R. A., Australian National Univ., Australia; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 28-29; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Considering that relatively few impact structures are known in Africa, it was of interest when preliminary geophysical, petrological, and geochemical investigations indicated that a large, near-circular magnetic and gravity anomaly in the area around Morokweng, Northwest Province, South Africa, may represent an impact structure. The subsurface structure, centered at 23 deg 32 sec E, 26 deg 31 sec S, shows a well-defined circular magnetic anomaly measuring about 70 km in diameter. Refined processing of the gravity and aeromagnetic data indicate the presence of a much larger circular structure with a diameter of about 340 km. Three drill cores were obtained from near the center of the structure; these showed the presence of melt rocks with high contents of siderophile elements. We found abundant opaque minerals in the Morokweng melt rock, including various types of magnetite, Cr- and Ni-rich spinel ilmenite and rutile (often intergrown), monazite, chalcocite, and trevorite. Zircon and baddeleyite (evidence for a high temperature origin) are also common. Remnants of PDFs are present in various unannealed clasts. The impact melt rock samples are remarkably uniform in composition. High contents of the siderophile elements were measured in the melt rock samples: up to 440 ppm of Cr, 50 ppm of Co, 780 ppm of Ni, and 32 ppb of Ir, with relatively little variation (less than a factor of 2). After correction for the indigenous component,a near-chondritic abundance range remains. PGE contents show a flat near-chondritic pattern, indicating the presence of about 2-5% of a chondritic component. to determine the age of this structure, zircons were extracted from a large melt-rock sample. The zircons were analyzed for their U-Th-Pb isotopic compositions on the ion microprobe SHRIMP I at the Research School of Earth Sciences, Australian National University. Using standard statistical

data analysis, a Pb-260/U-238 age of 146.2 +/- 1.5 Ma was calculated from this data set. This age is indistinguishable from the age of the Jurassic-Cretaceous (J/K) boundary, which is placed at the base of the Berriasian Stage at 145 Ma. This result, which is supported by other recent measurements, indicates that large scale impact events may have influenced the geological and biological evolution of the Earth to larger degree than was previously assumed. (Additional information is contained in the original).

Author

Breccia; Composition (Property); Geochemistry; Impact Melts; Meteoritic Composition; Chondrites; Meteorites; Projectile Cratering; Meteoritic Damage

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Deep Anatomy, Composition, and Evolution of Large Meteorite Impacts: Scientific Drilling Data on the Puchezh-Katunki Astrobleme, Russia

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The Puchezh-Katunki astrobleme (diameter = 80 km) lies in the eastern part of the Russian Platform. In the center of the astrobleme, a 5354-m-deep scientific borehole has been drilled. A complete sequence of an impact explosive structure is disclosed here. Two structural stages are specified within the sequence: (1) Precambrian basement (550-5354 m) and (2) the so-called Coptogeneous Complex, consisting of allogenic breccia and melt impactites (impact melt rocks) that carry diamonds. In deep parts of the structure (3500-5354 m), the basement rocks are weakly altered. At higher levels (1600-3500 m), the rocks are plasticized by the impact compression and brecciated as a result of relaxation. Higher up (500-600 m), in the relaxation fissures, thick (up to 30-m) IMR sheets occur. The thickness of the Coptogeneous Complex, which in the studied drillhole occupies an interval of 0-500 m, is smaller in the central rise of the crater (areal extent 40 sq km) and increases in an adjacent trough to 2500 m. From the data obtained from 1650 samples, detailed geological, petrological, and geochemical cross sections of the astrobleme were compiled; peculiarities of mineralogy and chemistry of the preimpact basement rocks and their varieties altered by shock pressure and temperature were established. Besides Pb, K-Ar, and Rb-SR, isotope studies were conducted with determinations of isotope ratios (SR-87/SR-86,He-3/He-4, and Ar-40/Ar-36). The following results were obtained (1) A preimpact age of the basement rocks (2.4 Ga), along with the impact-caused ”dating shift” (from 2.4 to 1.6 Ga) and the impact event (0.19 Ga), the latter accompanied by formation of impact melt rocks (IMR), was established; (2) similarity in the I(exp 0,sub SR), ratio in the preimpact basement rocks (0.704 to 0.708) and IMR (0.705 to 0.709) at different levels of the astrobleme sequence proved the in situ formation of IMR in an isochemical closed system; and (3) values of I(exp 0,sub SR), ratio in tagamites of the basement (0.707 to 0.709) and in the Coptogeneous Complex (0.711 to 0.713) were significantly different thus indicating formation of coptogeneous tagamites during the course of the hybride melting of the basement rocks and overlying sediments (I(exp 0,sub SR), from 0.720 to 0.738). The sediments carry the C(sub org) required to produce diamonds. The main features of a new geological and geochemcal evolutional model of the impact processes offered for discussion are as follows: (1) Impact compression: instanteous duration of hyperpressure prevented melting of the basement rocks and migration of produced fluids; alteration of solid minerals occurred at a relatively isochemical regime, with local diffusional redistribution of K, Na, Fe, Mg, and Al; (2) shock decompression: sharply decreased temperature after the shock wave had passed, along with uneven heating of the basement rocks, caused a selective melting of these rocks, with concurrent enrichment of IMR in K, Na, Pb, Fe, Mg, Cr, V, Ni, Sc, Co, Cu, Mn Ta, and TR. At greater depth, quasi-isochemical melts were formed. Along with decreasing pressure and related overheating, a retrograde boiling had occurred here; this was accompanied by a separation of the gaseous (vapor) fluids rich in K, Na, Li, Rb, SR, Mo, B, and Hg, whereas the melt had been enriched in Ti, Nb, Zr, and Fe; and (3) modification (i.e., relaxation and formation of the central rise): hydrothermal alteration of the basement rocks and the Coptogeneous Complex caused by the gas and vapor fluid attack; whereas the latter produced a smectite-zeolite assemblage in the upper levels of the sequence, an illite-chlorite assemblage was formed in the deep levels; a possibility existed for deposition of potentially productive Mo, Be, Ni, Co, Zn, B, In, and V accumulations.

Author

Geochemistry; Impact Melts; Meteoritic Composition; Mineralogy; Meteorites; Meteorite Craters; Geology

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Structure and Kinematics of a Complex Crater: Upheaval Dome, Southeast, Utah

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Two vastly different phenomena, extraterrestrial impact and salt diapirism, have been proposed for the origin of Upheaval Dome. Upheaval Dome is a about 2.5-km-diameter structural dome surrounded by a 5-km-diameter ring structural depression, which is in turn flanked by extensive, nearly flat-lying Colorado Plateau strata. Seismic refraction data and geologic mapping indicate that the dome originated by the collapse of a transient cavity formed by impact; data also show that rising salt has had a negligible influence on dome development. Evidence for this includes several factors: (1) a rare lag deposit of impactite is present; (2) fan-tailed fracture surfaces (shatter surfaces) and a few shattercones are present; (3) the top of the underlying salt horizon is at least 500 m below the center of the dome, with no exposures of salt in the dome to support the possibility that a salt diapir has ascended through it; (4) sedimentary strata in the center are significantly imbricated by top-to-the-center thrust faulting and are complexly folded; (5) top-to-the-center low-angle normal faults are found at the perimeter of the structure; and (6) clastic dikes are widespread. The scarcity of melt rocks and shock fabrics is attributed to approximately 0.5 km of erosion; the structures of the dome reflect processes of complex crater development at a depth of about 0.5 km below the crater floor. Based on mapping and kinematic analysis, we infer that the dome formed mainly by centerward motion of rock units along listric faults. Outcrop-scale folding and upturning of beds, especially common in the center, largely resulted from this motion. In addition, we have detected some centerward motion of fault-bounded wedges resulting from displacements on subhorizontal faults that conjoin and die out within horizontal bedding in the perimeter of the structure. Collectively, the observed deformation accounts for the creation of both the central uplift and the encircling ring syncline.

Author

Craters; Domes (Geology); Geological Surveys; Topography; Landforms; Cratering

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Can Impact-Generated Melts have Mantle Contributions?: Geochemical Evidence from the Sudbury Igneous Complex

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The -8000-km3, 1.85-Ga Sudbury Igneous Complex (SIC) and its giant Ni-Cu-PGE sulfide deposits are widely accepted as having been a consequence of the impact of a large meteorite close to the margin of the Superior Province and the Southern Province of the Canadian Shield. Models have variously ascribed the formation of the SIC and its giant Cu-Ni-PGE sulfide deposits to processes ranging from in situ melt sheet generation triggered by the impact event to derivation from a highly contaminated mantle-derived melt. We use an extensive new geochemical dataset, including a detailed chemical stratigraphy through the main part of the SIC, to constrain petrological models relating the different rock types that constitute the SIC. We show that the Main Mass Felsic Norite, Transition Zone Quartz Gabbro (TZQG), and Granophyre have similar ratios of highly incompatible trace elements (e.g., La/Sm = 4.5-7, La/Nb = 2.8-4.2, Th/Zr = 0.04-0.05). The fact that the three members of the Main Mass have very similar highly incompatible trace element ratios is regarded as strong evidence that they crystallized from the same or very similar magmas. Variations in major-, minor-, and trace element chemistry are consistent with the crystallization and differentiation of a similar magma type that was derived largely (>80%) from the upper crust The geochemical variations also suggest that crystallization of the Main Mass proceeded simultaneously both from its base and top; the TZQG may represent the mixing zone of the two residual magmas. (Cooling of the top of the SIC is believed to have been accelerated by heat loss to convecting fluids from an overlying water cover.) Although there is no direct evidence for a mantle contribution, a number of features of the SIC require a small (is less than 20%) contribution from a primitive component: (1) 1.85-Ga mafic-ultramafic fragments of olivine melanorite, websterite, wehrlite, and pyroxenite that occur as ”xenoliths” in the Sublayer of the SIC; (2) the dominant pyroxene over the lowermost 500 m of the Main Mass that is cumulus orthopyroxene; (3) Fo(sub 68-87) olivines with 450-3700 ppm Ni and chrome spinels in the matrix and inclusions; and (4) the large inventory of S, Ni, Cu., Co, and Pt group elements (PGE), which, for example, require a parental magma with is greater than 250 ppm Cu and is greater than 250 ppm. Although Re-Os and Pb-Pb isotope systematics of the sulfide mineralization are consistent with a crustal source for these metals, there is no crustal reservoir around the SIC that has sufficient Ni, Cu, Co, S, or PGE to account for the mineralization. We suggest that this primitive component was provided by picritic magmas that migrated from the mantle through the fracture system generated by the impact shortly after formation of the melt sheet; on entering the melt sheet, the picritic magmas mixed vigorously with the crustal melt to form a hybrid melt, which subsequently underwent solidification and fractionation as described above. Mixing of the picritic melt with the crustal melt prompted formation of magmatic sulfides that sank through the magma column,

depleting the melt in Ni, Cu, and PGE due to the marked compositional shift. The ”ultramafic” xenoliths may have formed from predominantly picritic melts that had not been as thoroughly mixed with the crustal melt as other mantle-derived picritic melts. Author

Impact Melts; Meteorites; Petrology; Meteorite Craters; Projectile Cratering; Meteoritic Damage; Earth Mantle

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Geological and Geochemical Relationships between the Contact Sublayer, Offsets, and Main Mass of the Sudbury Igneous Complex

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Many of the giant Ni-Cu-PGE sulfide deposits of the Sudbury Igneous Complex (SIC) are associated with a discontinuous unit at the base of the Main Mass known as the Sublayer, the remainder are associated with Offset (Quartz Diorite) Dikes. The Sublayer consists of two fragment-rich members: (1) a metamorphic-textured Footwall Breccia and (2) an igneous-textured Contact Sublayer. The Contact Sublayer occurs as a thick unit in depressions at the base of the SIC, termed embayments, and contains a range of inclusion types, such as diabase, melanorite, olivine melanorite, pyroxenite, wehrlite and dunite. The Igneous Textured Sublayer Matrix (ITSM) is geochemically distinct from the Main Mass norites. For example, the ITSM in the Whistle Mine has ratios of La/Sm = 3.8, La/Nb = 5.0, and Th/Zr = 0.02, whereas the Main Mass norites, quartz gabbros and granophyres have ratios of 4.5-7, 2.8 4.2, and 0.04-0.05 respectively. The homogeneous composition of the ITSM at Whistle Mine can be modeled with small amounts of assimilation of local country rock granitoids (about 10%), large degrees of assimilation of diabase inclusions not derived from the local country rocks (about 70%), and small contributions from the Main Mass magma type (about 20% mafic norite). However, there are significant differences in the composition of ITSM between different embayments that may reflect the degree of digestion of fragments of different composition. The melanorite inclusions in the Sublayer at Whistle Mine and the ITSM have essentially similar ratios of the incompatible trace elements, but they have similar high incompatible-element concentrations (e.g., olivine melanorites have 20-65 ppm Ce in rocks with 15-21 wt% MgO), 1-10% interstitial sulfide, up to 0.5% apatite, 1-15% biotite, and 1.85-Ga zircon and baddeleyite. The mafic-ultramafic inclusions are believed to be the broken-up remnants of an earlier cumulate formed at depth from a Main Mass magma. It is believed that their trace-element geochemistry is controlled by accessory minerals, such as apatite, zircon, and baddeleyite, that formed from late magmatic fluids. The Offset Dikes occur both radially and concentrically to the SIC. The Offset Dike quartz diorites share many similar geochemical traits to the Main Mass. For example, the Parkin Offset Dike has La/Sm, La/Nb, and Th/Zr ratios of 6.3, 4.5, and 0.05. The Offset Dikes have compositions intermediate between the felsic norite and the granophyre, and therefore crystallized from the same magma type; arguably, the unmineralized quartz diorites provide the best possible estimate of the original magma from which the SIC crystallized. In detail, there are subtle variations in composition within and between Offset Dikes, with the largest difference being between North and South Range Offsets. North Range Offset Dikes cut Archaean granitoids and gneisses and have low TiO2 2 and elevated SR, La/Yb, La/Sm, and Gd/Yb, whereas South Range Dikes cut Early Proterozoic sediments, mafic volcanics, and intrusions and have high Ti02 and low SR, La/Yb, Gd/Yb, La/Sm. These differences may be caused by the assimilation of different country rocks during emplacement of the dike. Interestingly, embayment-related leucocratic norites from the ”funnel” of the Whistle Mine embayment, where the Whistle embayment becomes the Whistle Offset, have La/Sm (6.2), La/Nb (5.0), and Th/Zr (0.02) ratios that are similar to the Main Mass and Offset Dikes ratios. Such rocks may represent the link between the ITSM of the sublayers and the quartz diorites of the Offsets.

Author

Geochemistry; Geology; Mineralogy; Minerals; Substrates; Meteorite Craters; Rock Intrusions; Meteoritic Damage; Ejecta

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Original Size and Shape of the Sudbury Structure

Lowman, P. D., Jr., NASA Goddard Space Flight Center, USA; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 31-32; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

This paper presents new evidence bearing on the original size and shape of the Sudbury impact structure. Current opinion is almost unanimous that the structure is a multiring basin with an original diameter of about 200 km and a circular shape that has since been shortened in a northwest-southeast direction by Penokean deformation Evidence for this interpretation, collected chiefly from north of the Sudbury Igneous Complex (SIC), includes supposed outer rings on LANDSAT imagery, distant occurrences of ”Sudbury breccia” (generally defined as pseudotachylite), shatter cone occurrences, and outliers of Huronian sedimentary rock thought to be down-faulted rings. New data from imaging radar and field work north of the SIC, however, contradict this evidence. Radar imagery shows no signs of the supposed outer rings mapped by earlier workers on LANDSAT

images. The most prominent ring has been found to be a chance alignment of two independent fracture sets. Radar imagery from the CCRS Convair 580, with look direction almost normal to the north rim of the SIC, shows no evidence of the rings despite strong look azimuth highlighting. Radar imagery has shown many unmapped diabase dikes north of the SIC. Several exposures of supposed Sudbury breccia are associated with these dikes or with Nipissing diabase intrusions, in some cases actually inside the dikes or directly continuous with them. They appear to be igneous intrusion breccias with no relation to impact. Shock-wave interaction at lithologic contacts cannot be invoked for most of these, because they are part of a northwest trending swarm cutting the SIC in the North Range, and hence too young for an impact origin. Similar diabase-related breccias and pseudotachylite-like veins have been found far outside the Sudbury area between Chapleau and Thessalon. Shatter cones north of the SIC are few and poorly developed, perhaps due to the coarse-grained Footwall rock, and cannot be considered a continuous zone analogous to their occurrence on the South Range in Huronian rocks. Supposed down-faulted outliers of Huronian rocks north of the SIC show no consistent relation to faulting, and the Huronian/Archean contact is locally erosional. Radar imagery and field-checking confirm Rousell's conclusion that the North Range has undergone little or no Penokean deformation. T'his implies that the plan view outline of the crater (floor of the SIC) is original. Extrapolation of the North Range as part of a circular arc leads to an impossibly great diameter. It is concluded that although Penokean deformation largely accounts for the structure's shape, the original crater was not circular and was much smaller than 200 km across.
Author
Shatter Cones; Meteorite Craters; Meteoritic Damage; Cratering; Projectile Cratering

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Three-Dimensional Modeling of Impactite Bodies of the Popigai Impact Crater, Russia
Masaitis, V. L., Karpinsky Geological Research Inst., USSR; Naumov, M. V., Karpinsky Geological Research Inst., USSR; Mashchak, M. S., Karpinsky Geological Research Inst., USSR; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 32-33; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Three-dimensional computer modeling of impactite bodies of the Popigai Crater (diameter = 100 km) was carried out on the basis of (1q) geological mapping, (2) core study of more than 500 drilling holes, and (3) study of gravitational anomalies. The geological bodies of monomict and polymict breccia, suevites, and tagamites were traced in detail on the local areas of about 50-100 km and to depths of about 0.5-1.5 km. Three hierarchical groups of objects were simulated: (1) the inner structure of the multiring impact crater; (2) the principal morphostructural elements; and (3) the large complex bodies of impact melt rocks. The principal structural elements of the crater are (1) central depression, (2) annular uplift surrounded by annular trough, and (3) numerous shallow radial troughs on the outer slope of the last. Both the relief of the true crater bottom and the entire distribution of molten and fragmented masses are characterized by asymmetry; in particular, centers of masses of impactites are displaced southwestward from the impact point. The true crater bottom is uneven and made up of megablocks of crystalline rocks (parautochton); relative lifting of blocks reaches up to some hundreds of meters. Lens-like and sheet-like bodies of impactites; and breccia fill annular trough and central depression. Their thickness is irregular, especially in the lower part of the sequence. Sheet-like bodies represent complicated combinations of different impact lithologies, mainly tagarnites (impact melt rocks) and suevites. The largest sheets (up to 600-m thick) are located on the outer slope of the circular uplift. Commonly, they occupy concentric depressions and are characterized by radial elements of inner structure. Overlapping is typical with displacements of mass centers of geological bodies and their interdigitations. The upper part of the sequence is made of more flat bodies with a less-expressed inner radial structure. The centers of masses of these bodies relative to the lower ones are located nearer to the center of the crater. The analysis of columns, distribution of masses of certain complicated bodies, their inner structures, and their interactions show that they were formed by the ejection of jets and currents with distinct trajectories and velocities. Irregular relief of the true bottom originated during a modification stage before sedimentation of the ejected material. Based unique geological data, three dimensional models give a real geological basis for reconstructions of large crater dynamics and mechanisms of transportation of melt and fragments ar the time of cratering.
Author
Geology; Three Dimensional Models; Computerized Simulation; Meteorite Craters; Meteoritic Damage; Meteorites

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Discovery of Impact Diamonds at the Sudbury Structure
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Planetary Evolution; 1997, pp. 33; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Impact diamonds were first discovered at the 100-km Popigai structure in Siberia. Since then impact diamonds have been found at Kara and Puchezh-Katunki, Russia, Boltysh, llyinets, Ternovka and Zapadnaja, Ukraine, and Ries, Germany. Impact diamonds are generally polycrystalline, usually lonsdaleite-bearing, and are regarded as high-pressure C polymorphs of precursor graphite or coal that has been shocked above 35 GPa. More recently, it has been suggested that some of the impact diamonds at the Ries, and possibly at Popigai, are the result of chemical vapor deposition. As impact diamonds occur most commonly in suevite breccias or rapidly cooled impact melt rocks, we concentrated our initial search for impact diamonds at the Sudbury Structure on the Onaping Formation, considered to be a mix of suevite and reworked suevite breccias. Particular attention was paid to the C-bearing Black Onaping, which is also the host of the reported fullerenes at Sudbury. Diamonds were discovered in two of eight samples of the Black Onaping. Other C phases included aggregates and single crystals of graphite, particles of hydrocarbons, and SiC (polytype 6H). The diamonds are polycrystalline aggregates measuring 0.1-0.6 mm in diameter They have various colors ranging from white to brown to black. The aggregates are relatively fragile and can be disaggregated by light pressing. The aggregates are relatively amorphous to blocky in morphology, and their surfaces are corroded and pitted. They contain impurities of graphite, either from incomplete transformation or reversion due to thermal effects during cooling of the 1.8-km-thick Onaping Formation. X-ray diffraction confirms their polycrystalline nature and indirates the presence of lonsdaleite (up to 20%) in some cases. Transmission electron microscope (TEM) analyses indicate mean grain sizes of individual crystallites in the 50- 100-mm range. Selected area electron diffraction patterns reveal preferred orientations of the crystallites, sometimes in 100-200-mm-thick layers, which may reflect the structure of the precursor graphite. Individual diamond crystallites are pervaded by numerous planar defects parallel to {111}, which likely represent stacking faults or microtwins. The n-Licrostructural characteristics are equivalent to those of so-called ”diamond paramorphs” from other impact structures and indicate a solid-state martensitic transformation of preexisting graphite by shock to form diamond. The Black Onaping contains 0.06-1.4% C with delta C-13 % -30.2 to -31.11, which suggested to Avermann that the source of C in the Onaping was from biogenetic material deposited into a local euxinic basin created by the Sudbury impact event. While this may be the case for some of the C, the presence of impact diamonds, graphite, SiC, and fullerenes indicate that there was one or more existing sources of C at Sudbury prior to the impact event. (Additional information is contained in the original).

Author

Diamonds; Polycrystals; Hypervelocity Impact; Crystallography; Meteorite Craters; Ejecta

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Diamonds Originated by Meteorite Impact: Magnetic and Other Properties

Masaitis, V. L., Karpinsky Geological Research Inst., USSR; Shafranovsky, G. I., Karpinsky Geological Research Inst., USSR; Kinnunen, K. A., Geological Survey of Finland, Finland; Pesonen, L. J., Geological Survey of Finland, Finland; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 33-34; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

About 25 years ago, the large Popigai impact structure was discovered in the northern part of East Siberia. The structure originated 35 Ma as a result of the collision of an 8-km asteroid with the Earth. The diameter of the complex crater is about 100 km, and it is filled by impactites (melt rocks and strongly shocked target rocks). Small graphite crystals in the metamorphic target rocks (e.g., gneiss) were transformed into diamonds as a result of high pressure exceeding 35 GPa. Such impact diamonds are included in some varieties of the Popigai impactites. The impact diamonds, because of their microgranular structure, are very tough compared to more fragile kimberlite diamonds and may therefore be used as industrial diamonds. Generally their diameters are approximately is less than 3 mm but may reach I cm. These diamonds inherit the tabular shape and some other pattern of graphite precursors and possess many mineralogical features that are distinct from the single crystal diamonds from kimberlite pipes. The impact diamonds are polycrystalline and are composed of cubic and hexagonal (lonsdaleite) high-pressure phases of C forming structurally arranged microcrystals. The diamonds may be transparent, but more often they are yellow, brown, and black. Some unusual optical features may be observed under the polarizing microscope, including high birefringence and entirely straight extinction. The C isotopic composition of impact diamonds was formed due to polymorphic transition of the precursor. (Additional information is contained in the original).

Author

Crystals; Diamonds; Mineralogy; Meteoritic Damage; Meteorite Craters

20000031469 Laurentian Univ. of Sudbury, Dept. of Earth Sciences, Ontario Canada

A Study of Mineral and Rock Fragments and Shock Features in the Late Granite Breccia at the Fraser Mine, North Range, Sudbury Structure

McCormick, K. A., Laurentian Univ. of Sudbury, Canada; James, R. S., Laurentian Univ. of Sudbury, Canada; Fedorowich, J. S., Falconbridge Ltd. (Exploration), Canada; Rousell, D. H., Laurentian Univ. of Sudbury, Canada; McDonald, A. M., Laurentian Univ. of Sudbury, Canada; Gibson, H. L., Laurentian Univ. of Sudbury, Canada; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 34; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Late Granite Breccia (Footwall Breccia) is a heterolithic breccia, post-Sudbury Breccia in age, that is present in irregularly shaped, discontinuous units, ranging from 0 to about 150 m thick, within the Sudbury Structure. It is exposed along the north, west, and east margins of the Sudbury Structure, where it occurs between the footwall Levack Gneiss Complex and the Sudbury Igneous Complex (SIC). The Late Granite Breccia (LGBX) is an important rock unit at Fraser Mine because it is the host for most of the Ni-Cu ores. This breccia is the focus of a detailed Falconbridge-funded study, the object of which is to identify mineralogical and geochemical criteria that indicate proximity to ore zones. Late Granite Breccia is composed of rock and mineral fragments that vary from is less than 1 mm to tens of meters in size. The mineral fragments are primarily quartz and feldspar, and the bulk chemistry of the breccia matrix varies from dioritic (or tonalitic) to granitic, roughly becoming more granitic toward the contact with the Archean rocks . Rock fragments (derived primarily from the local footwall) consist of felsic, intermediate, and mafic gneisses of the Levack Gneiss complex and fragments from mafic dikes that intrude the Levack complex. Sudbury breccia, (pseudotachylite breccia) fragments are generally rare, but can be locally abundant. Ultramafic rock fragments (primarily pyroxenite, but also peridotite) are locally present. Possible sources for the ultramafic fragments include footwall mafic to ultrarnafic bodies such as those at Strathcona and Fraser Mines, or the ”root system” of the Sudbury Igneous Complex. Some pyroxenite fragments may represent migmititic segments of the Levack Gneiss Complex. The percentages of various clast types in the LGBX, determined from one of the drill holes in this study, are 67% gneiss, 9% diabase and gabbro (local dikes), 6.5% pyroxenites, 10% amphibolites, 1.5% Sudbury breccia, and 6% other. We are also studying the various shock features preserved in quartz, feldspar, pyroxene, biotite and epidote in the matrix and rock fragments of the LGBX. The shock features we find include: (1) as many as three directions of hexagonally or rhombohedrally aligned inclusions in quartz (2) fractures in feldspar and epidote, (3) bent plagioclase twin lamellae, (4) possible deformation lamellae in feldspar, (5) finely space exsolution lamellae in Pyroxene, (6) shock decomposition of p[yroxene and biotite, and (7) kinked and oxidized biotite. The feldspar and quartz fragments in the LGBX are commonly polygonal in form (inequigranular to seriate) near the footwall. Remnant aligned inclusions in quartz are present in some of the individual polygons. Upward from the footwall, quartz typically becomes porphyrocrystic and encloses lath-like feldspar. Recrystallization of these phases could have been induced by the overall elevate temperatures of the shocked rocks, the thermal metamorphic effect of the cooling SIC above these breccias or a regional metamorphic event. Author

Breccia; Geochemistry; Mineralogy; Minerals; Meteorite Craters; Ejecta; Meteoritic Damage

20000031471 Kiel Univ., Geophysics, Germany

Integrated Geophysical Study of the Sudbury Structure

Milkereit, B., Kiel Univ., Germany; Boerner, D. E., Geological Survey of Canada, Canada; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 35; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Sudbury Structure is situated at the contact between the Early Proterozoic Huronian supracrustal rocks of the Southern Province and the Archean basement rocks of the Superior Province. Existing evidence strongly supports a meteoritic impact origin. The Sudbury Structure proper contains the Whitewater Group, which infills a central depression, the underlying SIC, and brecciated footwall rocks around the Sudbury Igneous Complex (SIC). Deducing the original three-dimensional shape of the structure by unraveling the deformation of the southern rim is of critical importance in distinguishing genetic models. The suite of geophysical experiments performed by the Canadian Lithoprobe program in the Sudbury transect area was selected to provide complementary information about the geometrical and lithological properties. Seismic reflection methods were the cornerstone of the transect studies and defined the framework for the geological interpretation of physical rock properties, borehole logging, potential field date, and electromagnetic (EM) data. Continuous reflections in the relatively pristine North Range data unambiguously delineate lithologies known from surface and drill intersections. The seismic data indicate that the highly reflective footwall complex and mafic units of the North Range continue dipping southward to a depth of about 5 km beneath the center of the basin and about 10 km beneath the Sudbury South Range. The seismic data from the South Range data are dominated by reflections from shear zones, faults, and other tectonized structures in the South Range Shear Zone (SRSZ), a broad zone of pervasive ductile shear. While the overall asymmetry of the Sudbury Structure at depth supports a model of crustal thickening

through imbrication, important information regarding the collisional style of the Penokean orogeny is preserved in the details of the three-dimensional trace of the SRSZ. Multiple crossings of the highly deformed South Range were conducted to map the shear zone in three dimensions. Borehole geophysical and laboratory studies confirm significant impedance contrast at contacts between key North Range lithologies. While some local variability is observed, no systematic differences in the acoustic properties exist along strike or between the North Range and South Range. The gravity response of the lithological model derived from interpretation of the North Range seismic data explains fully the observed gravity data and does not require cryptic bodies or footwall topography at depth. Conversely, the magnetic field data from the Sudbury Structure is dominated by small-scale post-tectonic features, such as highly susceptible dikes and alteration zones that are not necessarily apparent in the seismic data. Interpretation of geophysical data in the highly deformed portion of the South Range is difficult since lithological correlations are ambiguous. The electromagnetic survey data, however, indicate the presence of a south-dipping conductive layer, interpreted as the glide plane that mechanically decoupled the South Range deformation from the North Range.
Author
Geophysics; Hypervelocity Impact; Meteoritic Damage; Meteorite Craters; Projectile Cratering

20000031472 Imperial Coll. of Science and Technology, Dept. of Geology, London, UK
The Chicxulub Seismic Experiment: Crater Morphology
Morgan, J., Lunar and Planetary Inst., USA; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 35-36; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The precise size and morphology of the Chicxulub Crater have been in dispute, with interpretations ranging from a about 170-km diameter peak-ring crater to a is greater than 300-km multiring basin. It has been suggested that this size difference represents an order of magnitude difference in impact energy, with quite different consequences for potential environmental perturbation. The new seismic data indicate why there has been ambiguity in determining the crater's dimensions. The radial extent of the excavated cavity is not much larger than the minimum estimates that have been proposed. However, the outer structure appears to extend further than might be expected on the basis of this small inner cavity, because the crater, at least in the subsurface, appears to possess a multiring basin morphology. Apparently, elements of both models turn out to be substantially correct. (Additional information is contained in the original.)
Author
Morphology; Meteorite Craters; Impact Damage; Cratering; Seismology; Stratigraphy

20000031473 Indian School of Mines, Dept. of Applied Geology, Dhanbad, India
The Circular Structure at Ramgarh, India: An Astrobleme(?)
Nayak, V. K., Indian School of Mines, India; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 36; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

An isolated, nearly circular structure at Ramgarh (20 deg 20 min N , 76 deg 37 min 30 sec "E), Kota District, Rajasthan, India, is a prominent feature that occurs in sandstone-shale-limestone rocks of the Bhander Group of the Vindhyan Supergroup (mid-upper Proterozoic). The Deccan Basalts of Cretaceous-Eocene age are exposed 50 km south of the Ramgarh structure. The circular structure covers an area of 16 square km. The outer and inner diameters are 4 km and 2 km respectively; the average radius is about 3 km and the depth-to-diameter ratio is 0.05. The height of the rim is 200 m, and the highest point is 240 m from the surrounding area. Besides a raised rim, quaquaversal dips, inverted topography, uplifting of rocks in the center, a shatter cone, and shock metamorphic features have been reported, but their true nature has yet to be confirmed. The circular structure was described in the "Astronauts Guide to Terrestrial Impact Craters" as an impact crater with a ring of hills and a small central peak from the LANDSAT image. It is also interesting to note that the shape of the Ramgarh structure is not fully circular but somewhat rectangular and, as such, is analogous to the well-known Meteor Crater in Arizona, U.S. The origin of this spectacular feature has been a debated subject; from time to time, an overview of various explanations and suggestions is presented. These relate to meteoritic impact, tectonism, volcanic activity, kimberlite and carbonatite intrusions, subsidence, etc. The structure has been suggested to be an impact crater and a dome. The drilling and geophysical data ruled out any possibility of kimberlite, carbonatite, subsidence, and igneous activity as the causative factors in the evolution of the Ramgarh structure. From the evaluation of various explanations, drilling, and geophysical data, it is envisaged that the Ramgarh structure is most likely related to the impact of a meteorite and perhaps impact-induced tectonism. The origin of this enigmatic structure still remains inconclusive and at present it seems reasonable to consider it as "Ramgarh Astrobleme"(?), until more definitive evidence, such as impact breccia and melt, coesite, stishovite, and other shock-metamorphic characteristics, is recognized and confirmed. A multidisciplinary approach is

proposed to resolve conclusively the origin and age of the Ramgarh astrobleme; in turn, this could lead to further important contributions to the Earth's cratering history.
Author
Shatter Cones; Topography; Meteoritic Damage; Formations; Structural Properties (Geology)

20000031474 Lulea Univ., Div. of Applied Geophysics, Sweden
The Lycksele Structure, A Huge Ring Formation in Northern Sweden: Result of an Impact?
Nisca, D. H., Lulea Univ., Sweden; Thunehed, H., Lulea Univ., Sweden; Pesonen, L. J., Geological Survey of Finland, Finland; Elming, S.-A., Lulea Univ., Sweden; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 36-37; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The current database of impact structures in Fennoscandia reveals 28 proven impact craters of various ages and sizes. Recently, we started to search for large and old impact structures, which may show traces of the impact in their shape or in their rocks and minerals and which can be diagnostically identified through the masking effects of postimpact deformations. Since we are dealing with strongly eroded and often deformed structures, the classical criteria for proving an impact origin are not tenable. Through a combined analysis of topography, drainage, gravity, magnetic, and petrophysical data, a circular structure has been identified in northern Sweden. The structure is characterized by a circular system of faults, arc-shaped contacts between rocks, and a circular distribution of granitic intrusions. The fault zone at the edges is defined from gradients in the gravity data, from magnetic data by arc-shaped anomalies, and from topographic data by an arc-shaped relief, which is also reflected in the drainage pattern. The zone is characterized by vertical faults that also cut the granitic intrusions at the edge of the formation, and from interpretation of gravity data an uplift of high density rocks (about 2850 kg/m(exp 3)) is indicated in the central part. The age of granites and pegmatites ranges from 1.82 to 1.78 Ga. Therefore, based on age data and on paleomagnetic results of various generations of dikes that cut and are truncated by the structure, the age of the formation lies within 1.80-1.26 Ga. The rocks have not been studied petrologically to see if any traces of shock metamorphism can be found. At present, four models for the origin of the structure are possible: (1) basement doming, (2) meteorite impact, (3) large buried pluton, or (4) fault-bounded block. An impact origin, however, seems most plausible. (Additional information contained in original.)
Author
Deformation; Meteorite Collisions; Rock Intrusions; Topography; Meteorite Craters; Cratering; Ejecta

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Chicxulub Impact Ejecta in Belize
Ocampo, A., Jet Propulsion Lab., California Inst. of Tech., USA; Pope, K., Geo Eco Arc Research, USA; Fischer, A., University of Southern California, USA; Alvarez, W., California Univ., USA; Fouke, B., California Univ., USA; Asaro, F., California Univ., Lawrence Berkeley Lab., USA; Webster, C., Jr., Loma Linda Univ., USA; Vega, F., Ciudad Univ., Mexico; Smith, J., Vrije Univ., Netherlands; Fritsche, A. E., California State Univ., USA; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 37-38; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Chicxulub ejecta deposits in Belize provide the closest exposures of ejecta to the crater and the only exposures of proximal ejecta deposited in a terrestrial environment. A quarry on Albion Island in northern Belize exposes Late Cretaceous, possibly Maastrichtian, carbonate platform sediments that were folded, eroded, and subaerially weathered prior to the deposition of coarse ejecta from Chicxulub. These ejecta deposits are composed of a basal, about 1-m-thick clay and dolomite Spheroid Bed overlain by a about 15-m-thick coarse Diamictite Bed. Many and perhaps most of the clay spheroids are altered glass. Many dolomite spheroids have concentric layers and angular cores are probably of accretionary lapilli origin. A slight Ir concentration (111-152 ppt) was detected in the base of the Spheroid Bed. The Diamictite Bed contains about 10% altered glass, rare shocked quartz, 3-8 m diameter boulders and striated and polished cobbles, one with a penetrating rock chip that plastically deformed the cobble. Ejecta deposits extend to the surface at Albion and the maximum thickness in this area is not known. Ejecta deposits are exposed in several roadside quarries in the Cayo District of central Belize. The Late Cretaceous here is also represented by carbonate platform sediments. The upper surface of the carbonate platform is a highly irregular and extensively recrystallized horizon possibly representing deep karst weathering. Approximately 30 in of diamictite overlies this horizon with a texture similar to the Diamictite Bed at the Albion quarry, but with a more diverse lithology. In three locations the Cayo diamictites, contain red clay layers with abundant polished and striated limestone pebbles and cobbles called Pook's Pebbles, several of which have penetrating rock chips and ablated surfaces. We interpret the Albion Spheroid Bed as a deposit from the impact vapor plume and the Albion and Cayo diamictites as the result of a turbulent flow that contained debris derived from the ejecta curtain and local scouring. The polished, striated, and ablated Pook's Pebbles are interpreted as high altitude ballistic ejecta.
Author
Ejecta; Plastic Deformation; Rocks; Spheroids; Impact Damage; Meteoritic Damage

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Geological Setting of the Manchester Offset Dike within the South Range of the Sudbury Impact Structure

OConnor, J. P., New Brunswick Univ., Canada; Spray, J. G., New Brunswick Univ., Canada; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 38; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Manchester Offset Dike is located about 5 km southeast of the Sudbury Igneous Complex (SIC) within the Huronian metasedimentary footwall rocks of the 1.85-Ga Sudbury Impact Structure. The Offset Dike is subconcentric to the SIC and is up to 30 m wide. It strikes discontinuously for at least 10 km, within which occurs a thicker central continuous zone about 5 km in length, and it dips about 60 degrees to the southeast. It is hosted by a zone of Sudbury Breccia (pseudotachylyte) that in part defines the so-called Falcon Fault. The host pseudotachylyte is also discontinuous and up to 350 m thick. Contacts between the pseudotachylyte and the dike are generally sharp. The dike is chilled against the breccia and typically comprises the assemblage quartz + piagioclase + alkali feldspar + amphibole + biotite. Granophyric and myrmekitic intergrowths are particularly common. Clinopyroxene relicts also occur. The dike is a quartz diorite and, although clearly genetically related to the SIC, is more siliceous than many of the other offsets of the Sudbury Structure. This may reflect the effects of assimilating the quartzo-felds-pathic wall rocks. Critical to this study is the original mode of connection between the Manchester Offset and the SIC, since there is no apparent physical attachment between the two at present exposure levels. Field studies indicate that the Offset dike may have been emplaced from below, via listric faulting initiated during the collapse of the transient cavity sometime after hypervelocity impact. Author

Breccia; Geological Faults; Rock Intrusions; Impact Damage; Cratering; Meteorite Craters

20000031477 Stockholm Univ., Dept. of Geology and Geochemistry, Sweden

The Middle Ordovician Lockne Crater as a Small-Scale Model for Impacts at Sea

Ormo, J., Stockholm Univ., Sweden; Lindstrom, M., Stockholm Univ., Sweden; Sturkell, E., Stockholm Univ., Sweden; Tornberg, R., Stockholm Univ., Sweden; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 38; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Lockne Crater is situated in the county of Jamtland in central Sweden. It is one of six known craters from Baltoscandia and North America formed at different water depths in the Middle Ordovician sea. The structure was soon covered by Caledonian overthrusting and was protected from erosion until the Cenozoic. The morphology and lithology of the crater is therefore well preserved. The water depth at the time of impact was at least 200 m. The target rocks consisted of approximately 80 m of sedimentary rocks covering the crystalline basement. The water and the sediments served as a weak upper layer. The structure is phenomenologically a nested crater. The 7.5-km-wide inner crater is developed in the crystalline basement and surrounded by a shallow, 3-km-wide, outer crater developed in the sedimentary strata and the topmost part of the crystalline rocks. No clear rim has been observed. This was most likely partly developed in the water mass and collapsed moments after the impact. The resurging water was heavily loaded with debris, and the resulting high-density flows eroded deep gullies through the outer crater. The resurge material filled most of the inner crater with a mixed breccia.Because water and wet sediments more easily form a melt than crystalline rocks, more energy is available for the excavation. This results in craters with 20-50 % larger diameters than those that would result from a single crystalline target. Although sediments are more easily melted, melt sheets are seldom found in craters with sedimentary targets. The water and carbonates form volatiles that disperse the melt. In the Lockne structure, no melt sheet or suevite layer has been found through extensive search,both with drillings and with geophysics.
Author

Breccia; Sediments; Water; Meteorite Craters; Cratering; Meteoritic Damage; Ejecta

20000031478 Muenster Univ., Institut fuer Planetologie, Germany

The Sudbury Igneous Complex (SIC) as Impact Melt Layer: Geochemical Evidence for In Situ Differentiation

Ostermann, M., Muenster Univ., Germany; Deutsch, A., Muenster Univ., Germany; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 38-39; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The 1.85-Ga Sudbury Igneous Complex (SIC) of the Sudbury multiring impact structure , together with the coeval class-rich impact melt breccias, the Sublayer, and the the Offset Dikes, is herein interpreted as the product of an in situ! differentiation of a homogeneous impact melt. The origin of the SIC by impact melting of crustal lithologies has already been demonstrated, yet the genetic relationships between the SIC lithologies, i.e., norite, quartz-gabbro, and granophyre, have remained controversial. New major-, minor-, and trace-element data, as well as SR-Nd isotope characteristics for the continuously sampled drillcore 70011, indicate for the first time that these lithologies are linked by in situ differentiation, without the need for additional assimilation of crustal rocks or contributions from the contemporaneous subcontinental mantle. Drill Core 70011 Geochemistry:

The concentrations of most elements change continously over the 2.5-km-thick SIC. The norite/ quartz-gabbro transition, however, is characterized by a relatively sharp increase in TiO2 21 P205, 2 V, Sc, and Zr, as well as a sudden drop in SiO2 . This seemingly distinct boundary is not a discontinuity; rather, it reflects cooling of the SIC liquid below a thermal boundary, corresponding to the upper stability of Fe-Ti-oxides, apatite, and sphene. The quartz-gabbro, therefore, compares well with Fe-Ti-oxide (apatite-rich transition zones at true magmatic ”layered intrusions’). The Fe2O3/MgO ratio varies smoothly over the SIC, reaching a maximum in the lower third of the granophyre. All these features are well known from differentiated endogenic magmatic bodies of a homogeneous starting composition. Except for the silica-rich initial composition, and the origin by impact melting of the crust, the evolution of the SIC as delineated by elemental concentration profiles in the drill core 70011 matches that of, for example, the Skaergaard Intrusion. The hypothesis that the felsic (granophyre) and the mafic (quartz-gabbro, norite) units of the SIC have been produced by different processes can clearly be rejected on the basis of our geochemical results. Typical features of a gravitational differentiation (for example, cumulate layers) are missing in the case of the SIC. In situ differentiation, therefore, is assumed to be the mechanism for the chemical evolution of the impact melt pool. The Offset Dikes, discussed as ”separate magmatic pulse,” unambiguously belong to the impact melt system as exemplified by our investigation of the Foy Offset. Total absence of inherited zircons demonstrates that the melt in the dikes was superheated; SR-Nd isotope parameters as well as geochemical data reveal again crustal precursor material and a composition close to the norites in the North Range of the SIC. Therefore, the Offset Dikes must have been formed in a late stage of cratering when differentiation of the SIC had begun. Numerical modeling of the cooling history of the SIC indicates that emplacement of the Offset Dikes occurred not later than 0.25 m.y. after the impact event. (Additional information is contained in the original.)
Author
Geochemistry; Impact Melts; Lithology; Rock Intrusions; Substrates; Meteorite Craters; Meteoritic Damage; Cratering

20000031479 Geological Survey of Finland, Espoo, Finland
The Karikkoselka Impact Structure, Central Finland: New Geophysical and Petrographic Results
Pesonen, L. J., Geological Survey of Finland, Finland; Elo, S., Geological Survey of Finland, Finland; Puranen, R., Geological Survey of Finland, Finland; Jokinen, T., Geological Survey of Finland, Finland; Lehtinen, M., Finnish Museum of Natural History, Finland; Kivekas, L., Geological Survey of Finland, Finland; Suppala, I., Geological Survey of Finland, Finland; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 39-40; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Karikkoselka, the seventh recognized impact structure in Finland, was discovered in 1995 because of the strikingly circular shape and unusual bathymetry of the lake. This partly preserved simple impact structure with an estimated diameter of 1.2-1.4 km lies in a Palaeoproterozoic porphyritic granite. A comprehensive geophysical and petrographic study of the structure was carried out in 1996. Here we report new results providing a model for the structure and an estimate of its age. Samples of porphyritic granite from the lake shore outcrops show marks of shatter cones and shock metamorphism. One boulder sample is an impact breccia consisting of rock and mineral clasts of various grain sizes cemented by rock powder. Most of the quartz clasts (diameter about 1 mm) contain planar deformation features (PDFs), in addition, feldspars show mosaicism and incipient vesiculation, and biotite flakes are strongly kinked. The closely spaced, partially decorated PDFs usually occur in three to four sets of orientations. Low-altitude (25-45 m), two-frequency (3125 and 14368 Hz), aeroelectromagnetic (AEM), SAMPO wideband (2-20000 Hz), electromagnetic (EM), and detailed gravity profiles all show anomalies related to the structure. The amplitude of the residual gravity anomaly is -4 mGal, and the density of the unaffected bedrock is estimated to be 2650 kg/m(exp 3). The gravity data define the locations and dips of the contacts of the whole structure. Based on gravity modeling, the crater fill is about 140 m thick if a typical density contrast of 225 kg/m(exp 3) is assumed. The gravity data also indicate a slight decrease of density in the bedrock surrounding the crater proper. This effect increases the diameter of the anomalous structure to 2.1-2.4 km. The AEM and EM results delineate the horizontal layer structure with estimates of typical resistivities. The in-phase AEM anomaly is distinctly higher than the corresponding anomalies of typical Finnish lakes, which might serve as a diagnostic criteria in the search for impact structures. Based on geophysical data, the structure can be described by a bowl-shaped model of four layers and slightly altered bedrock around and below the crater. The first layer consists of water (20 m) with a (winter) resistivity of 400 m and a density of 1000 kg/cubic meter. Below this is a triplet layer with an about 5 m veneer of Quaternary mud on top (density 1050-1910 kg/cubic meter resistivity 30-60 m). The middle part is a 45-m-thick layer with a resistivity of 65 m, and the bottom part is a 20-m-thick low-resistivity (20 m) layer. The triplet layer, lying on highly resistive granite (>5000 m), is interpreted to be either postimpact sedimentary rocks or allochtonous suevite and impact breccia. Preliminary palaeomagnetic data reveal three remanence directions. Samples far away from the lake show a Svecofennian (1880 Ma) magnetization (=unshocked). A very stable magnetization of reversed polarity characterizes the southeast and northwest sites of the lake. This direction corresponds to a magnetization of either Triassic (-230 Ma), or, if alternative polarity interperetation is adopted, Cambrian (-530 Ma) age, when

interpolated from the Phanerozoic APWP-curve of the Fermoscandian Shield. The origin and nature of this probably impact-related, remanent magnetization is as yet unknown. A drilling of the structure is planned for winter 1998.
Author
Geophysics; Gravitation; Metamorphism (Geology); Petrography; Meteorite Craters; Ejecta; Meteoritic Damage; Impact Damage; Cratering

20000031480 Lunar and Planetary Inst., Houston, TX USA
Hydrocode Simulations of Chicxulub as an Oblique Impact Event
Pierazzo, E., Lunar and Planetary Inst., USA; Crawford, D. A., Sandia National Labs., USA; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 40; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Since the confirmation that the buried Chicxulub structure is the Cretaceous-Tertiary boundary crater long searched for, numerous efforts have been devoted to modeling the impact event and trying to estimate the amount of target material that underwent melting and vaporization Several two-dimensional hydrocodes have been used to simulate vertical impacts on targets that resemble the target lithology at Chicxulub. It is clear, however, that real impact events are rarely vertical, and the most probable angle of impact of a randomly incident projectile is 45 degrees. Consequently, any conclusion based on two-dimensional models is severely affected by this simplification, and fundamental details of the impact event cannot be reproduced. Schultz and D'Hondt have recently noted how the impact angle could be responsible for possible asymmetries in the K/T boundary record of extinctions. We present the first tHree-dimensional simulation of the Chicxulub event as an oblique impact. A preliminary estimate for the amount of sediments and crust material melted and/or vaporized in the impact has been calculated and compared to previous two-dimensional results. The simulation, carried out using the shock-physics computational hydrocode CTH developed at Sandia National Laboratories, consists of spherical, 10-km-diameter projectile impacting the target at 45 degrees from the normal with an impact velocity of 20 km/s. The target layout is similar to previous two-dimensional simulations. A 30-km grantic crust on top of the mantle is overlain by a sedimentary layer 2.9 km thick. A shallow sea (100 m deep) completes the target. The materials used for this simulation are dunite for the mantle and projectile, granite for the crust, calcite/limestone for the sedimentary layer, and water for the sea. The introduction of an atmosphere allows a better representation of the plume evolution for terrestrial impacts. One thousand tracer particles have been distributed regularly in both the target and the projectile. Through a method successfully used for two-dimensional simulations, the maximum shock pressure experienced by each tracer has been used to reconstruct and evaluate the amount of target material that underwent melting or degassing. Most of the melting and degassing occurs downrange from the impact point. We estimate that around 930 cubic km of the sedimentary layer is shocked at pressures is greater than 100 GPa, and about 4400 cubic km of sediments is shocked at pressures is greater than 20 GPa. A pressure of 100 GPa is generally used as the threshold pressure for the degassing of anhydrite, which represents one of the main sources of S in the target, while we use 20 GPa as the threshold pressure for the degassing of porous calcite. In comparison, the corresponding two-dimensional simulation carried out with CSQ produced about 450 cubic km of sedimentary layer shocked above 100 GPa and 1990 cubic km of sediments shocked above 20 GPa. The two calculations differ by about a factor of 2. On the other hand, the amount of crust shocked above 56 GPa, the pressure corresponding to complete melting of granite, is only about 9000 cubic km for the three-dimensional calculation, vs. an estimate of about 14,000 cubic km in the two-dimensional case. Recent experimental work on oblique impacts indicates an increase of vaporization of the surface layers of the target (in particular, experiments where the surface layer was made of carbonates were carried out) as the impact angle (measured from the normal to the surface) increases. One of the results of the experiments is a weakening of the shock wave as function of the impact angle. In this case the lower amount of melting of the crust is a logical result of a weaker shock propagating in the target. Further work, in particular at different impact angles, is needed to verify the consistency of this result.
Author
Cretaceous-Tertiary Boundary; Computerized Simulation; Mathematical Models; Meteorite Collisions; Meteoritic Damage; Meteorite Craters; Projectile Cratering

20000031483 Tartu Univ., Inst. of Geology, Tartu, Estonia
Gravity and Magnetic Modeling of a Complex Impact Structure: Effect of Deformation and Erosion
Plado J., Tartu Univ., Estonia; Pesonen, J., Geological Survey of Finland, Finland; Puura, V., Tartu Univ., Estonia; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 42; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The relatively small number (about 155) of verified meteorite impact structures on Earth is mainly due to tectonic activity and terrestrial erosion, both of which may partially or totally erase the geological signatures of old impact structures Terrestrial geological processes such as deformation, postimpact sedimentation, and subsequent erosion also play a role in the changes of

the geophysical anomalies of terrestrial impact structures. Although there have been numerous attempts to model the geophysical anomalies of impact structures, little effort has been made to model the changes in the geophysical anomalies as a function of deformation and erosion. to this end, we present two case histories. In the first case, we have calculated geophysical anomalies related to the 4-km diameter, 0.5-km-deep Kardla impact structure for the hypothetical cases of further burial (0.1 -km-tbick cover) and erosion (removal of the 0.1-0.3-km-thick uppermost layer). It was discovered that the influence of burial on the detection of ring structures by gravity and magnetic data is not as destructive as erosion. In the second case, we have tried to carry out gravity and magnetic modeling as applied to a complex hypothetical impact structure (1.2 km in depth, 30 km in diameter) whose schemes were published by Rondot and Melosh. The target on the model approximately simulates the Precambrian geology of the Baltic Shield in southwestern Finland. The modeling was done using 16 simulated radial profiles across the center of the structure. In the modeling, we looked at the progressive changes in the geophysical anomalies of this structure at six successive geological situations: (1) preimpact, (2) impact, (3) deformation, and (4-6) three erosional levels. We have used 2.5 dimensional modeling where the geological units are defined as homogeneous polygonal prisms with different strikes. Each unit has specified petrophysical characteristics (density, magnetic susceptibility, and natural remanent magnetization, the latter two as vector properties). The calculated gravity and magnetic anomalies at the various stages are presented as contour maps and profiles to demonstrate the effect of deformation and erosion on geophysical signatures. The 2.5-dimensional modeling approach produces two problems. First, the software does not allow gravity and magnetic data to be calculated for profiles outside the model structure. Second, data on top of the model are slightly incorrect because of a failure to take into account the three-dimensional effects. Using three-dimensional gravity software, we are able to demonstrate that the 2.5 -dimensional program produces errors up to 15% for off-structure calculation points. These errors are not randomly located, and, therefore, the geophysical anomaly patterns show ”butterfly”-type features that are purely artifacts of the model. Despite these drawbacks, the signature of the impact in geophysical data is clearly visible as circular anomaly patterns. Our impact model shows a slightly distorted circular gravity anomaly, with a -18 mGal amplitude, as well as a circular negative relief on a magnetic map. We found that simple tectonic deformation (such as faulting) and erosion of 2 km below the target level (1/15 of the crater diameter) does not destroy the circular gravity and magnetic anomalies of the structure. Even with 4 km of erosion (1/7.5 of the crater diameter), we can still see traces of the gravity and magnetic impact anomalies.

Author

Geology; Geophysics; Meteorite Collisions; Relief Maps; Meteoritic Damage; Two Dimensional Models; Impact Damage

20000031484 Geological Survey, Woods Hole, MA USA

The Chesapeake Bay Structure: Earth’s largest Submarine Peak-Ring Impact Crater

Poag, C. W., Geological Survey, USA; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 43-44; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

More than 1200 km of seismic reflection profiles, four cores of impact breccia, and a bull’s-eye negative gravity anomaly document the buried Chesapeake Bay impact crater. Its structure and morphology indicate that the feature is a complex peak-ring crater that also exhibits a small central peak. The 90-km-wide crater was excavated from mixed-target lithologies comprising 300-1000 m of sedimentary strata overlying crystalline basement rocks (granitic and metasedimentary rocks of the Appalachian orogen). Biochronologic and paleoenvironmental analyses indicate that the bolide struck the late Eocene inner continental shelf (200-500 m water depth) about 35 Ma. The impact took place within a 0.8-m.y. interval in which the upper part of planktonic foraminiferal biochronozone P15 overlaps the lower part of the calcareous nannoplankton biochronozone NP19-20. Due to its submarine location, marine sedimentation resumed immediately following the impact and buried the crater under 300-400 m of mostly marine, shallow-water deposits. Because of its submarine origin, immediate burial, and location on a passive continental margin, the structure has undergone virtually no erosion or tectonic alteration, and is therefore unusually well preserved. Only three other well-documented impact craters (and an additional possible impact crater) are currently known to be partly or entirely buried beneath marine waters. The principal characteristics can be compared to the Chesapeake Bay crater. The Chesapeake Bay structure is currently the largest, and perhaps the only, submarine peak-ring crater identified on Earth. Its shallow burial and easy accessibility to geophysical surveys and coring provide a good opportunity to study the detailed structural, morphological, erosional, and depositional consequences of bolide impacts into mixed target rocks under shallow seas. (Additional information is contained in the original.)

Author

Bolides; Chesapeake Bay (US); Meteorite Craters; Meteoritic Damage; Projectile Cratering; Cratering; Geophysics

20000031485 Rieskratermuseum Noerdlingen, Noerdlingen, Germany

The Public Interest In Impact Cratering: The Ries Crater Museum, Noerdlingen, Germany

Poesges, G., Rieskratermuseum Noerdlingen, Germany; Schieber, M., Rieskratermuseum Noerdlingen, Germany; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 43; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

After five years of preparation, the Rieskrater-Museum was opened in May 1990. The museum is dedicated to the presentation of the Ries impact, its planetary roots, its importance for a better understanding of cosmic interactions, the geology of the Jura mountains, and the development of the landscape after the impact. to this day the museum has been visited by approximately 350,000 visitors. More than 1500 tours of the museum and some 60 field excursions have been arranged. The museum, which includes 800 ml of floor space, is subdivided into six rooms for the presentation of the following topics: (I) Room A: geomorphology and geographical position of the Ries Crater; (2) Room B: our planetary system, including types of impact craters, meteorite systematics, distribution of impact craters on the planet Earth, a video about the origin of our planetary system, and the meaning and importance of impacts; (3) Room C: preimpact geology of the Ries, with displays on the impact point, crater mechanics, NASA experiments, and progressive shock wave metamorphism; (4) Room D: formation of the Ries impact structure, including information on the types of impact rocks, a geological cross section of the crater, drill cores, and a slide show of the crater formation; (5) Room E: Ries lake deposits and fossils, landscape development, exploitation of postimpact rocks, land utilization; and (6) Room F: Ries Crater research history, lunar samples, and an Apollo 16 mission video. The average number of visitors per year indicates a great interest of the public in impact processes and impact hazards on our globe, especially after the Shoemaker-Levy event in 1994 and encounters with Comet Hyakutake in 1996 and Comet Hate-Bopp in 1997. The great number of tours of the museum, as well as field excursions, is also due to the conception of a modem museum in one of the best-known craters on Earth. Among the numerous annual visitors are schoolchildren, students, and members of scientific societies; many revisit the museum at regular intervals. The staff in the museum make it their business to act as a transmitter in conveying science and research results to the public. They participate in scientific congresses and have established contacts with planetary scientists, museums, NASA, and other research institutions. to this day, three scientific societies have held meetings in the museum: the European Science Foundation (1993), the Meteoritical Society (1994), and Gesellschaft fur Geowisssenschaften (1995). Separate exhibits present the research results of these meetings and other events. (Additional information is contained in the original.)

Author

Museums; Meteorite Craters; Public Relations; Promotion

20000031486 Moscow State Univ., Geological Dept., Russia

Morphology of Diamonds from Impactites and Metamorphic Rocks

Posukhova, T. V., Moscow State Univ., Russia; Nadezhdina, E. D., Moscow State Univ., Russia; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 43-44; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The main sources of diamond crystals (kimberlites, lamproites, etc.) are well known. The morphology of diamonds from impactites and metamorphic rocks, however, is uncommon and not as well known. Metamorphic diamonds are known from Kazakhstan, China, and Norway. They are very small (0.01-0.01 mm) and have a yellow color and anomaly refraction. Their mineral companions are garnet, zircon, graphite, mica, rutile, titanite, and kyanite. The concentration of N and REE impurities in these diamonds is high. They have very weak yellow-green luminescence and unusual forms, with no dodecahedra and very few octahedra. Several crystal forms can be seen in these rocks: skeletal and sphere, faced (antiskeletal) and edge rays, boxy and tabular forms, and unusual aggregate aggregate skeletal cubic crystals formed by coarse-layered blocks. We investigated different crystals and proposed their morphological classification. The comparison of the metamorphic and synthetic diamonds warrants application of the growth theory to explain the specific morphology of the metamorphic diamond. The diamonds crystallized very quickly by fibrous mechanism of growth, during a short time at nonequilibrium conditions with low temperature and pressure from the supersaturated solutions that were rich in impurities. A fast saturation of mineral solution caused the formation of a great number of crystal embryos. This explains very small sizes of metamorphic diamonds and the frequent occurrence of twins. The impurities increase the speed of growth and make the diamond defective. The diamonds acquired unhomogeneous sector and zone structure, which is characteristic of metamorphic diamonds. Typomorphic features of diamonds from impactites are the same as paramorphozes by graphite. Their mineral satellites are quartz, pyrite, ilmenite, hematite, graphite, and glass. They are commonly gray and black and have an uncommon isotopic composition (13.2-18.8% delta C-13) and impurities (lonsdeilite and much REE). They have an anisotropy refraction and weak yellow and red-orange luminescence. They consist of hexagonal, plate, and xenomorphic aggregates of small crystallites (grains= 0.1-10 x 10 (exp -4) - 10(exp -2) mm). Their surfaces are plain, hatching, shading, gofer, flexure, cellular, and cavernous. Their structure is polycrystalline, strongly textured, stratified, and strained.

Comparisons with experimental data give us a foundation to speculate on the origin of impact diamonds, believed to be the recrystallization of graphite at high temperature, pressure, and velocity of growth. Such conditions may be realized during the meteoritic fall, which would account for anomalous stresses and temperatures.
Author
Crystallization; Crystals; Metamorphism (Geology); Morphology; Meteoritic Diamonds; Impact Damage; Meteoritic Damage

20000031487 Laurentian Univ. of Sudbury, Dept. of Earth Sciences, Ontario Canada
Postmagmatic Zircon Growth or Exotic Early Magmatic Phases Associated with the Emplacement of the Sudbury Igneous Complex: Samarium-Neodymium Isotopic, Geochemical, and Petrographic Evidence
Prevec, S. A., Laurentian Univ. of Sudbury, Canada; Keays, R. R., Laurentian Univ. of Sudbury, Canada; Corfu, F., Royal Ontario Museum, Canada; Moore, M. L., Geoservices Centre, Canada; Lightfoot, P. C., Inco Ltd., Canada; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 44; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The timing of both the crystallization of the Sudbury Igneous Complex (SIC) end the shock deformation of the country rocks within the contact aureole has been reliably established using a variety of isotopic techniques, including U-Pb in zircon and baddeleyite, Rb-SR in whole rocks, and Re-Os in o es. The physical evidence of shock metamorphism in affected rocks and mineral grains has been well characterized. However, in a number of cases, ca. 1850-Ma ages have been produced from zircons in a variety of Footwall breccia-hosted rocks where petrologic and geochemical arguments strongly suggest that the true crystallization age predates the zircon age. Samples from a plagioclase-phyric basaltic to diabasic raft at Whistle mine, an ultramafic intrusion in the North Range Footwall at Fraser mine, and a metaleucogabbro-noritic sill in Drury Township have been studied during the course of various studies of SIC and Huronian magmatism. All these bodies lie within the immediate Footwall rocks adjacent to the basal Main Mass or Sublayer norite and well within the contact metamorphic aureole of the SIC. These units are characterized by suites of magmatic-textured zircons with U-Pb ages within error of 1850 Ma. The zircon populations vary in habit, color, and U content between units and are consistent with igneous magmatic origins, although they are different in character from similarly aged SIC zircons. However, all these units are characterized by Sm-Nd isotopic and trace element geochemical signatures that clearly distinguish them from SIC magmatic material. Epsilon(sub Nd)(sup 1850) values range from -2.2 to -5.8, in contrast to SIC values of -6.8 to -9. 1. Trace-element abundances are significantly lower and show flatter mantle-normalized profiles than do SIC samples. Petrographic evidence from the plag-phyric and ultramafic bodies is indicative of deformation of preexisting magmatic textures, distinguishable from later regional upper greenschist grade metamorphic overprinting. Finally, older correlative rocks present in adjacent country rock show geochemistry and isotopic signatures comparable to the bodies in question. The variation in morphologies and chemistry of the 1850-Ma zircons in these bodies, plus the morphologies themselves, would appear to be inconsistent with crystallization from pervasive, SIC-induced hydrothermal fluids. The evidence therefore requires either the growth of magmatic-looking zircons in existing rocks, where the geochemistry of the host rock or at least the immediate environment plays a role in the mineral growth, or alternatively, the emplacement of exotic magma batches (possibly remelted Footwall or lower crustal rocks) in the early stages of formation of the SIC followed by subsequent deformation and local incorporation into the noritic Sublayer magmas.
Author
Crystallization; Geochemistry; Isotopes; Petrography; Deformation; Zirconates; Crystal Growth; Crystallography; Meteoritic Damage

20000031488 Laurentian Univ. of Sudbury, Dept. of Earth Sciences, Ontario Canada
Origin of the Sublayer of the Sudbury Igneous Complex: Samarium-Neodynium Isotopic, Geochemical, and Petrographic Evidence for Incomplete Crustal Homogenization
Prevec, S. A., Laurentian Univ. of Sudbury, Canada; Corfu, F., Royal Ontario Museum, Canada; Moore, M. L., Geoservices Centre, Canada; Lightfoot, P. C., Inco Ltd., Canada; Keays, R. R., Laurentian Univ. of Sudbury, Canada; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 44-45; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The major repository of Ni sulfides in the 1850-Ma Sudbury Igneous Complex (SIC) is the discontinuous marginal zone known as the Sublayer. The Sublayer is characterized by the presence of large amounts of sulfide and a variety of inclusions, ranging from xenocrysts to decameter-sized blocks. The inclusions can be broadly subdivided into five groups: (1) felsic or granitic (sensu lato) xenoliths attributable to proximal country rock; (2) ultramafic inclusions, including peridotite (generally rare), olivine melanorite, and pyroxenite; (3) plagioclase-phyric, recrystallized ”anhedral porhyries”; (4) and anorthositic fragments; and (5) centimeter-scale felsic or anorthositic blebs. The anhedral porphyries are distinguished from the other SIC rocks and inclusions therein in that they display relatively flat chondrite-normalized REE profiles [e.g., (Ce/Yb)(sub N) = 3, as

compared to values around 8-9 for the Main Mass and is greater than 20 for North Range country rock] and have a very limited, relatively depleted range of Epsilon(sub Nd) (sup 1850) values, from -2.2 to -5.4, in contrast to values of -6.8 to -9.1 for the Main Mass and Offset Dikes. The Sublayer displays isotopic and trace element geochemical characteristics consistent with derivation from materials represented by its inclusion population, among which the anhedral porphyries are prominent. Sublayer Epsilon(sub Nd) (sup 1850) values range between -5.5 and -7.5, and REE abundances and ratios are intermediate between those of the porphyries and those of the country rocks. A comparison of the Sm-Nd isotopic and geochemical signature of the anhedral porphyries with those of Early Proterozoic (ca. 2470 Ma) mafic volcanics of the basal Huronian Supergroup and the associated plutons (i.e., "East Bull Lake-type") and dikes (i.e., Matachewan) indicates strong similarities to these populations, particularly with the Huronian tholeiitic basalts and the Matachewan dikes. Geochemical variation diagrams show a prominent influence from this Huronian component as a mixing end member for SIC magmas, particularly to the Sublayer. Sublayer magmas can be described, at least qualitatively, in terms of mixtures between this Huronian component and Archean basement (in particular the Levack Gneiss Complex thought to underlie the SIC), with additional variation induced by mineralogical control, in particular by orthopyroxene, and incompatible-element-enriched accessory minerals (e.g., apatite). The association of mineralization in the Sublayer and offsets with the presence of anhedral porphyry inclusions can be used to infer that the source of the metalliferous sulfides in the SIC may have been the Early Proterozoic mafic suite. Much of this suite is well mineralized with Cu, Ni, and PGE (in particular Nipissing and East Bull Lake-type intrusives). Impact-induced melting and variable assimilation of Huronian country rock could have induced variable segregation and reconsolidation of the preexisting sulfides and subsequent redeposition into "traps" such as the Sublayer troughs. The major inconsistency with this premise is that the Cu./Ni ratio of Huronian mineralization is on average generally much higher than that observed in the SIC. The alternative, a contribution from juvenile mantle, is not supported by any direct evidence. However, the addition of a relatively small (i.e., is less than 10%), well-homogenized picritic contribution (such as from the lithospheric mantle), which could provide an alternate source for the metals, cannot be ruled out.

Author

Geochemistry; Inclusions; Petrography; Meteorite Craters; Earth Crust; Mineralogy

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Geochemical and Samarium-Neodymium Isotopic Evidence Regarding the Origin of Offset Dikes of the Sudbury Igneous Complex, Ontario

Prevec, S. A., Laurentian Univ. of Sudbury, Canada; Xie, Q., Laurentian Univ. of Sudbury, Canada; Keays, R. R., Laurentian Univ. of Sudbury, Canada; Lightfoot, P. C., Inco Ltd., Canada; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 45; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

One of the magmatic features that distinguishes the Sudbury Igneous Complex (SIC) from potentially comparable igneous layered mafic intrusions is the presence of relatively leucocratic linear vertical dikes extending into the country rock. These bodies, known as Offset Dikes, may be divided into two categories on the basis of their geometric relationship to the SIC and are described as radial and concentric dikes. While the majority of the identified offsets project radially outward into the footwall rocks from the base of the SIC at the Sublayer, a smaller number have been identified that run subparallel to the SIC contact and may be found between 4 km (Manchester Offset) and 12 km from the SIC (in Hess Township). In addition, within individual offsets, a marginal relatively inclusion- and sulfide-poor facies and a central, inclusion- and sulfide-rich facies have been identified. Although early workers grouped Offset and Sublayer magmas as subtypes of the same phase of the SIC, recent geochemical work has indicated both relatively homogeneous and relatively incompatible-element-enriched geochemistry in offsets, more comparable to Main Mass Norites than to Sublayer. Samarium-neodymium isotopic data from Parkin Offset in the North Range indicate a homogeneous signature consistent with a large crustal component The Epsilon(sub Nd) (sup 1850) values for the offsets vary around -8.0, comparable to new and existing data from the main mass. Incompatible-trace-element geochemical variation within a given offset is relatively small, and average compositions of offsets from the North and South ranges display variations consistent with strong influence from the local country rock. Offsets emplaced within the North Range Archean gneisses and granitoids display race-element abundances that are similar to one another and slightly enriched relative to average main-mass felsic norite. In contrast, offsets emplaced into South and East Range Proterozoic metavolcanic and metasedimentary rocks display trace-element abundance profiles that differ from one another and from the North Range Offset signature. Although inclusions within the central facies of the offsets have quite distinctive isotopic and geochemical signatures, the host quartz noritic to quartz dioritic offset rocks show minimal variation either along or across strike within an offset, as profiled in examples from the Foy and Hess offsets in the North Range and the Worthington Offset in the South Range. The marginal offset facies may show geochemical evidence for local footwall assimilation. In addition, there is no systematic geochemical distinction between the radial Foy Offset and the longitudinal Hess Offset. Given that the offset magmas were emplaced into shock-induced and/or existing crustal fractures, a mechanism is required whereby the relatively leuconoritic melts pooled at the base of the melt sheet

and assimilated and homogenized local footwall material. Sulfide mineralization (as a fractionating sulfide liquid and then solid solution) and the prominent mafic and ultramafic inclusion population associated with the Sublayer and the offsets were then introduced. The offset magmas were either released into the fractures as homogenous dike-like bodies carrying the inclusions and sulfides entrained within or were emplaced prior to Sublayer development and acquired inclusions and sulfides that settled out of the Sublayer.
Author
Geochemistry; Mineralogy; Rock Intrusions; Substrates; Samarium Isotopes; Neodymium Isotopes; Meteorite Craters

20000031490 Oulu Univ., Dept. of Geosciences and Astronomy, Finland
Postimpact Impactite Phase
Raitala, J., Oulu Univ., Finland; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 45-46; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Shock-related changes in feldspar composition were found by Feldman. The diaplectic mineral zone fracturing was substituted by concentric and radial fractures across crystal boundaries in the amorphous zone when the pressure exceeded 30 GPa. With pressures is greater than 60 GPa, the high-shocked metamorphic phase consisted of impact melt. Significantly the feldspar composition remained unaltered until 25 GPa, but after that there was increased cation migration by increasing pressure. The exchange of K and Na was found between albite and K-feldspar as well as a cation outflow from feldspars. The authors suggested that this cation exchange zone width could be used as a shock-metamorphic geobarometer. This idea, as well as the processes that allow the cation exchange in impactites, should be studied in detail. Impactite mineral changes may derive from the two main impact-related events: the high-to-vibrating pressure impact event and/or an extended thermal postimpact time. Both of these events may result in the cation exchange between the heated and crushed/ melted matrix phase and surviving/new crystals. An extremely fast cation exchange or depletion may occur during the high-pressurized vibration phase immediately following the impact and mechanical crushing of the rock. Another possibility is a high-temperature postimpact environment that results in an extended cation diffusion between remaining crystals and the milled and/or melted matrix material, where new crystals are formed if the duration of the thermal phase is long enough. It may be difficult to distinguish between the two processes. The vibrational pressure phase may be most effective if two or three active mineral phases are present in the rock. The hot low-pressure phase that follows may favor additional cation exchange between the remaining crystals and the melted matrix. Both effects may be limited to edge zones of remaining crystal phases where the diffusive distance is the shortest. Cation migration paths through the whole crystal lattice are slower and more difficult and may take place in the case of the largest impacts where melt is abundantly present and the cooling time is long enough to allow reactions between crystal and melt phases. A long cooling time and high-temperature and concentration gradient increase the cation migration. The two alternative metamorphoses (impact event shock-metamorphosis and thermal postimpact metamorphosis) have to be reconsidered according to the ideas of Feldman. These more straightforward impact-induced changes need to be contrasted against previous suggestions of the effects of the late high-temperature environment in diffusional cation exchange between garnet crystals and the surrounding matrix during the extended thermal postimpact period. High and low pressure may favor different outflow and inflow at the crystal's edge zones. The high temperature and concentration gradient also increase diffusion coefficient and cation migration The shock-wave effects may be favored if most of the cation migration is limited to crystal edge zones where the diffusive distance is shortest. Longer cation migration paths through the crystal lattice and a possible equilibrium between the crystals and/ or the matrix materials may support the effects of the extended thermal phase. Even if the impact and postimpact phases produce qualitatively similar changes, the heated low-pressure postimpact phase may provide a more balanced outcome of the crystal-matrix cation diffusion. This is especially evident in the case where a reasonable amount of melt is present. Samples collected from deep levels or from large craters should show more signs of the thermal phase. There is more time for controlled diffusion in the thermal phase than the shock-vibration phase.
Author
Cations; Impact Melts; Impact Damage; Feldspars; Mineralogy

20000031491 NASA Goddard Space Flight Center, Greenbelt, MD USA
Impact Crises, Mass Extinctions, and Galactic Dynamics: A Unified Theory
Rampino, M.R., NASA Goddard Space Flight Center, USA; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 46-47; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A general hypothesis linking mass extinctions of life with impacts of large asteroids and comets is based on astronomical data, impact dynamics, and geological information. The waiting times of large-body impacts on the Earth, derived from the flux of Earth-crossing asteroids and comets, and the estimated size of impacts capable of causing large-scale environmental disasters predict that impacts of objects (sup 3)5 km in diameter ((sup 3)10(exp 7) Mt TNT equivalent) could be sufficient to explain the

record of about 25 extinction pulses in the last 540 m.y., with the five recorded major mass extinctions related to the impacts of the largest objects of (sup 3)10 km in diameter ((sup 3)10(exp 8) Mt events). Smaller impacts (about 10(exp 6)-10(exp 7) Mt), with significant regional and even global environmental effects, could be responsible for the lesser boundaries in the geologic record. Tests of the ”kill curve” relationship for impact-induced extinctions based on new data on extinction intensities and several well-dated large impact craters suggest that major mass extinctions require large impacts, and that a step in the kill curve may exist at impacts that produce craters of -100 km diameter, with smaller impacts capable of only relatively weak extinction pulses. Single impact craters is less than about 60 km in diameter should not be associated with global extinction pulses detectable in the Sepkoski database (although they may explain stage and zone boundaries marked by lesser faunal turnover), but multiple impacts in that size range may produce significant stepped extinction pulses. Statistical tests of the last occurrences of species at mass-extinction boundaries are generally consistent with predictions for abrupt or stepped extinctions, and several boundaries are known to show ”catastrophic” signatures of environmental disasters and biomass crash, impoverished postextinction fauna and flora dominated by stress-tolerant and opportunistic species, and gradual ecological recovery and radiation of new taxa. Isotopic and other geochemical signatures are also generally consistent with the expected after-effects of catastrophic impacts. Seven of the recognized extinction pulses are associated with concurrent (in some cases multiple) stratigraphic impact markers (e.g., layers with high Ir, shocked minerals, microtektites), and/or large, dated impact craters. Other less-well-studied crisis intervals show elevated Ir, still well below that of the K/T spike, which might be explained by low-Ir impactors, ejecta blowoff, or the sedimentary reworking and dilution of impact signatures. The best explanation for a possible periodic component of about 30 m.y. in mass extinctions and clusters of impacts is the modulation of the comet flux associated with the solar system’s periodic passage through the plane of the Milky Way Galaxy. The quantitative agreement among paleontological, geological, and astronomical data suggests an important underlying unification of the processes involved.

Author

Extinction; Hypotheses; Cometary Collisions; Asteroid Collisions; Meteorite Collisions; Meteoritic Damage; Paleobiology; Paleontology

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Striations, Polish, and Related Features from Clasts in Impact-Ejecta Deposits and the ”Tillite Problem”

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Proximal ejecta deposits related to three large terrestrial impacts, the 14.8-Ma Ries impact structure in Germany (the Bunte Breccia), the 65-Ma Chicxulub impact structure in the Yucatan (the Albion and Pook’s Hill Diamictites in Belize) and the mid-Tertiary Azuara impact structure in Spain (the Pelarda Fm.) occur in the form of widespread debris-flow deposits most likely originating from ballistic processes. These impact-related diamictites typically are poorly sorted, containing grain sizes from clay to large boulders and blocks, and commonly display evidence of mass flow, including preferred orientation of long axes of clasts, class imbrication, flow noses, plugs and pods of coarse debris, and internal shear planes. Clasts of various lithologies show faceting, various degrees of rounding, striations (including nailhead striae), crescentic chattermarks, mirror-like polish, percussion marks, pitting, and penetration features. Considering the impact history of the Earth, it is surprising that so few ballistic ejecta, deposits have been discovered, unless the preservation potential is extremely low, or such materials exist but have been overlooked or misidentified as other types of geologic deposits . Debris-flow diamictites of various kinds have been reported in the geologic record, but these are commonly attributed to glaciation based on the coarse and poorly sorted nature of the deposits and, in many cases, on the presence of clasts showing features considered diagnostic of glacial action, including striations of various kinds, polish, and pitting. These diamictites are the primary evidence for ancient ice ages. We present evidence of the surface features on clasts from known proximal ejecta debris-flow deposits and compare these features with those reported in diamictites. interpreted as ancient glacial deposits (tillites). Our purpose is to document the types of features seen on clasts in diamictites of ejecta origin in order to help in the interpretation of the origin of ancient diamictites. The recognition of characteristic features in clast populations in ancient diamictites may allow identification and discrimination of debris-flow deposits of various origins (e.g., impact glacial, tectonic) and may shed light on some climatic paradoxes, such as inferred Proterozoic glaciations at low paleolatitudes.

Author

Breccia; Debris; Ejecta; Meteorite Craters; Projectile Cratering

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Vredefort 1997: A Controversy Resolved--Still a Challenge for the Future

Reimold, W. U., Witwatersrand Univ., South Africa; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 47-48; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

At Sudbury '92, a rather confusing image of the Vredefort Structure in South Africa was presented. No definite shock evidence had been obtained, and a major stumbling block on the way toward universal acceptance of an impact origin for this structure was the alleged existence of multiple generations of "pseudotachylites." The critical reception this presentation met with led to the continuation of multidisciplinary studies in South Africa and kindled the interest of some overseas workers. The following years brought a wealth of new information bearing on the origin of the Vredefort Structure and its relationship to the surrounding Witwatersrand Basin. Milestone results included (1) the confirmation that most pseudotachylitic breccia was formed at ca. 2 Ga, (2) the recognition of bona fide shock-metamorphic effects in quartz and zircon, (3) U-Pb single zircon dating of pseudotachylitic breccia at 2023 +/- 4 Ma, providing the first well-constrained age for the impact event, and (4) the identification of a trace meteoritic component in Vredefort Granophyre. Scaling of deformation effects and integrated geophysical modeling resulted in estimates for the original size of the Vredefort impact Structure of about 300 km. The impact origin of the Vredefort Structure, as well as the fact that it represents one of the three largest impact structures known on Earth, has now been resolved convincingly. The Vredefort Dome was recognized as the root zone of the central uplift structure of a much larger, Witwatersrand Basin-wide, impact structure. Vredefort provides, in comparison to the less deeply eroded Sudbury and Chicxulub structures, a window into the deep-level structure of a very large impact structure. However, recent work casts doubt on the validity of several earlier conclusions, including the stratigraphy of the basement core, previously believed to represent an extension of the upturned collar strata ("Crust-on-edge" model), and the alleged presence of a Vredefort Discontinuity between Outer Granite Gneiss and Inlandsee Leucogranofels. The nature of the general deformation styles exposed in the basement core is less than well understood, and the role of various possible heat sources that could have contributed to the regional thermal metamorphism is still debated. Another aspect of vital importance to the understanding of large impact structures and for future exploitation of the economic resources of the Witwatersrand Basin is the nature of the macrodeformation throughout the basin and which aspects of it are of pre-, syn-, and postimpact age. These and other remaining problems must be addressed through detailed mapping and geophysical study. In addition, the vast Witwatersrand drill-core repository and structural information pertaining to the whole basin need to be reexamined from an impact-geological view.

Author

Breccia; Geophysics; Meteoritic Damage; Meteorite Craters

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Paleoproterozoic Tectonism in the Eastern Penokean Orogen and its Significance for the Origin of the Norite of the Sudbury Igneous Complex

Riller, U., Wuerzburg Univ., Germany; Schwerdtner, W. M., Toronto Univ., Canada; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 48; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Lower Huronian supracrustal rocks host the 2.3-Ga granitoid Creighton and Murray plutons and form the southern footwall of the 1.85-Ga synformal Sudbury Igneous Complex (SIC). Understanding the history and style of Paleoproterozoic deformation of these rocks is necessary m constrain the primary geometry and origin of the SIC. An interpretation of the SIC as a thick impact-melt sheet that differentiated in situ into a granophyre, gabbro, and norite layer has recently gained popularity, but this interpretation requires geometric modification of the horizontal melt sheet by noncylindrical folding. Alternatively, models in which the SIC is regarded as a discordant funnel-shaped intrusion or as a combination of an intrusive component (the norite) and an impact melt (the granophyre) are open to discussion. Because of their proximity to the SIC, the preservation of synformal Huronian outliers in Archean granitoids, high-grade metamorphic rocks of the Levack gneiss complex, and overturned Huronian strata in the southern footwall have often been linked to impact cratering. We attribute these effects to crustal doming (noncylindrical buckling) during the Blezardian tectonic pulse, ca. 2.4-2.2 Ga. This led to the formation of broad antiforms cored by Archean basement and tight synformal keels of Huronian cover rocks in the eastern Penokean Orogen. Synkinematic emplacement of the Creighton and Murray granitoid sheets into the hinge zone of a south-verging dome, larger than the SIC at the present erosion level, constrains the age of doming in the Sudbury area. Furthermore, structures attributed to steepening of Huronian strata in the southern footwall of the SIC are cut by unstrained norite. Large amounts of shear-related tilting of Huronian strata after emplacement of the norite are therefore implausible. Although buckle folding was a major deformation process during the Penokean tectonic pulse (ca. 1.9-1.75 Ga), shortening of the SIC appears to have been accomplished mostly by northwestward translation of the South Range along thrust surfaces of the South Range Shear Zone. Stain fabrics of this shear zone are continuous with, and kinematically related to, granitoid and quartzite mylonite at the basement-cover interface southwest of the SIC and are

most likely linked to the Murray Fault. The paucity of ductile strain fabrics in the southwestern nose of the norite sheet and in its thermal aureole suggest that the norite nose is not due to high-amplitude buckling after its solidification. Furthermore, uniform northwest-southeast-directed contraction indicated by small-scale brittle discontinuities is incompatible with noncylindrical folding of the SIC at a late stage of Penokean deformation. In summary, new structural data and insights do not support an origin of the norite with a simple horizontal sheet geometry (i.e., impact melting). Therefore, we favor an intrusive origin of the norite whereby its emplacement and deformation were strongly controlled by preexisting curved lithotectonic interfaces.
Author
Impact Melts; Rocks; Tectonics; Meteorite Craters; Ejecta; Cratering; Meteoritic Damage

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Charlevoix and Sudbury as Simple Readjusted Craters
Rondot, J., Astrobleme Exploration, Canada; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 48-49; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The geomorphometry of the Charlevoix astrobleme (Quebec) is easy to measure because of slipping out of allothonous breccia in the Saint-Laurent depression, which has left a hollow in the Precambrian shield. Here we can observe the crater rim (D), an annular graben between .64 D + 13% and 0.64 D - 13%, a crown of small hills in the inner plateau, a small inner depression at 0.32 D +/- 13%, which is also the lowest part of the crater with impactite and the limit of the central uplift, and finally, for Charlevoix, Manicouagan, etc., a central peak at 0.13 D, not always in the center. The modification stage of the original crater at 0.5 D has been made by slipping of great masses of terrain along listric surfaces, which are faults with a special type of breccia (mylolisthenite). In Charlevoix, mylolisthenite dikes have a mostly cataclastic matrix with 10% to is greater than 60% of fragments of former breccia. These dikes are concentrated around the central uplift, near the inner depression, in the graben, and at the rim. There are also injected impactite dikes in the floor of the excavated crater and filling of transient crevices by allochthonous debris to the rim in the open listric fault. Geomorphometry of the Ries (Germany) will help to compare Charlevoix with Sudbury. Features include a rim (D) at 26 km, a ring of subsidence of the sedimentary cover at 0.64 D, and a basin at 0.4 D, with the deepest part at 0.32 D, which is 0.030 D below the old surface (measurements are based on a schematic cross section determined by geophysical methods). The inside crater suevite is about 0.015-D thick. Geomorphometry of the Sudbury Structure (Ontario) is similar to that of the Ries, with a central basin and a crown of down-faulted Huronian outliers. Since the time of the discovery of the structure as an astrobleme by Dietz, the estimated diameter of the structure has grown (100-120 km, 140 km, 190-200 km, 175-245 km, and 200-280 km). The center of the Sudbury Structure before deformation can be placed at the southwestern end of Lake Kelly, based on the deposition of the Huronian outliers in an arc. They begin 49 km from that point. At 0.48 D, as it is for the beginning of Ordovician beds in the Siljan graben, the diameter is given as 200 km. Peredery and Morrison found dike breccia at the northwestern arm of Lake Temagami 99 km from the center or 200 km from the final diameter. That diameter would give the thickness of the SIB 0.015 D as 3 km, measured in Deutsch et al. Sudbury is a simple readjusted crater as Charlevoix but with a central uplift proportionately 15% less important in volume. The Creighton granite was uplifted at least 14 km before Penokean deformation. (Additional information is contained in the original document.)
Author
Debris; Terrain; Meteorite Craters; Geomorphology; Rock Intrusions; Meteoritic Damage

20000031496 Laurentian Univ. of Sudbury, Dept. of Earth Sciences, Ontario Canada
Do Outliers of the Huronian Supergroup Mark the Downfaulted Rim of the Sudbury Crater?
Rousell, D. H., Laurentian Univ. of Sudbury, Canada; Long, D. G. F., Laurentian Univ. of Sudbury, Canada; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 49; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A series of outliers of the Paleoproterozoic Huronian Supergroup is preserved in a 20-km-wide arcuate belt northwest of the Sudbury Igneous Complex. Forty years ago it was suggested that these outliners represented the remnants of a discontinuous syncline. Ten years later it was proposed that they were preserved in grabens formed as a result of collapse of a multiring impact crater associated with emplacement of die Sudbury Igneous Complex. This interpretation has been accepted by most subsequent investigators without question, to the extent that that position of the outliers has been used to estimate the size of the supposed crater. Our observations indicate that Huronian strata in the outliers were deposited in a series of paleo-valleys on a terrane with considerable topographic relief The asymmetric nature of the fill in some of the outliers suggests deposition may have taken place in half-grabens. The outliers are preserved in synclines developed during an early phase of the Penokean Orogeny, prior to 1850

Ma. These were cut by later transverse, oblique, and longitudinal faults. The geometry of the outliers, combined with the character and directional attributes of the sedimentary fill, indicates that the outliers are not related to the Sudbury event.
Author
Geological Faults; Topography; Meteorite Craters; Ejecta; Outliers (Landforms); Meteoritic Damage

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Impact-Induced Melting of Granitic Rock Samples in Shock Experiments
Schrand, C., Muenster Univ., Germany; Deutsch, A., Muenster Univ., Germany; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 49-50; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

For the simulation of impact-induced melting phenomena on Earth, a granitic whole-rock sample has been shocked at 85 GPa using a high-explosive reverberation technique modified according to Hornemann. Peak shock temperatures reached in reverberation experiments are significantly lower than those reached in natural impact processes. to compensate for this effect, the device was preheated at 935 K to force whole-rock melting. Peak pressure duration in the experiment a amounted to about 1 microsecond. After the shock, the sample container was quenched; sample recovery was close to 100%. The thin section was investigated using optical microscopy, Reflection Electron MIcroscopy (REM), and electron microprobe techniques. The experiment was performed with a both-sides-polished, cylindrical disk (diameter = 15 mm, thickness = 0.5 mm) of granite from St. Blasien, Black Forest (Germany). This rock with a mean grain size of 0. 1-0.3 mm is composed of 31.6 vol.% quartz, 32% plagioclase (An(sub 8-38))), 20.3% K-feldspar, 14.3% biotite, and 1.8% apatite and zircon. The main characteristic of the shocked granite is the total loss of the original texture. The recovered sample displays diaplectic as well as shock-fused melt glass with textural and compositional heterogeneities on the micrometer scale. Most parts of plagioclase and K-feldspar are transformed to melt glasses with a high density of vesicles. Biotite is transformed to vesicular melt glass with flow structures pervading large parts of the sample, For the first time in experimentally shocked rocks, we have observed tiny spinels (magnesio-spinet-hercynite solid solution with minor ulvospinel, magnetite, and chromite components) and biotite crystals, newly crystallized from the shock-induced biotite melt. Evidence for the total melting of quartz grains is lacking; the cores of individual grains consist of diaplectic glass with a high density of bubbles. Their alignment along roughly parallel planes indicates that these bubbles are remnants of fluid inclusions in the quartz of the unshocked reference rock. Quartz fragments is less than 50 micron incorporated in mobile vesicular melts show a 2-micron-thick glass rim reflecting the incipient dissolution and mixing with the surrounding melt. Still smaller fragments are transformed to droplets of shock-fused quartz glass. The original grain boundaries between K-feldspar, biotite and plagioclase are in part lined with impact-melt glasses containing schlieren with a high degree of compositional heterogeneity on the micrometer scale. The presence of such melt glasses establishes that the threshold for shock melting was reached in the experiment, despite the short peak pressure pulse. In its overall characteristics, the experimentally shocked granite sample resembles highly shocked gneiss clasts reported from the allochthonous breccia lens at the Haughton impact structure in Canada.
Author
Granite; Melting; Optical Reflection; Impact Damage; Impact Melts; Meteorites

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Constraints on the Nature and Distribution of Iridium Host Phases at the Cretaceous-Tertiary Boundary: Implications for Projectile Identity and dispersal on impact
Schuraytz, B. C., NASA Johnson Space Center, USA; Lindstrom, D. J., NASA Johnson Space Center, USA; Sharpton, V. L., Lunar and Planetary Inst., USA; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 50-51; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Among Cretaceous-Tertiary boundary sites worldwide, variations in the concentrations and ratios of elements commonly enriched in meteorites complicate traditional geochemical attempts at impactor identification. Yet they may provide constraints on the physical and chemical processes associated with large-body disruption and dispersal, as well as with diagenesis of projectile components. to this end, we continue our efforts to identify the mineral host-phases of projectile-derived elements, particularly for Ir, and to document their partitioning between crater deposits and ejecta resulting from the Chicxulub basin-forming impact. Building on earlier work, we used INAA to measure Ir concentrations in successively smaller splits of finely powdered impact melt breccia from the Chicxulub Crater in Mexico (sample Y6Nl9-R(b)), and K/T boundary fish clay from Stevns Klint, Denmark (sample FC-1, split from 40 kg of homogenized material intended as an analytical standard). Results for the Chicxulub sample show a heterogeneous Ir distribution and document that at least five discrete Ir-bearing host phases were isolated in subsequent splits, having Ir masses equivalent to pure Ir spheres from about 0.8 to about 3.5 mm in diameter. Three of these are within a sufficiently reduced mass of powder to warrant searching for them using backscattered electron microscopy. In contrast,

successively smaller splits of the Stevns Klint fish clay show no statistically significant deviation from the reported value of 32 +/- 2 ng/g Ir, suggesting a uniform Ir host-phase distribution. For the smallest split obtained thus far (100 +/- 40 ng/g Ir), a pure Ir sphere of equivalent Ir mass would be is less than 0.05 min in diameter. (n.b. Although homogenizing and sieving of FC-1 to is less than 75 min obviously obscured variations in stratigraphic distribution, it is unlikely to have affected the size-frequency distribution of Ir host phases.) We previously identified micrometer-scale Ir host phases by electron microscopy in melt-rock samples from two widely separated drill holes at the Chicxulub Basin, including a replicate split of Y6-NI9-R. One is an aggregate of subhedral Ir metal grains enclosed in silicate, in which no other Pt group elements (PGE) were detected. A second particle with twice the mass as the first, concentrated predominantly in a single grain, is associated with minor concentrations of Os, Ru, and Pt, and with adhering particles of corundum and perovskite. A third Ir-rich particle, with a greater apparent Os concentration, was identified before being lost as a result of charging under the electron beam. In addition to demonstrating the preservation of projectile components within the Chicxulub Crater, analogous phase associations in Ca- and Al-rich inclusions (CAI) from C2 and C3 chondrites suggest to us that these melt-rock Ir host phases are relics from a carbonaceous chondrite K/T boundary impactor Although the obviously low Ru/Ir ratios of the Chicxulub Ir host phases are qualitatively consistent with suggested PGE fractionation with distance during condensation in an ejecta cloud, it seems difficult to explain the accumulation of the about 3 x 10(exp 11) Ir atoms required to form a about 10(exp -10) g nugget of pure Ir metal within a jet of vaporized projectile expanding at 1-4 km/s, or to effectively exclude or remove commonly alloyed PGE and siderophile elements by fractionation processes resulting from condensation, oxidation, sulfidization, exsolution, or autometamorphism during cooling of the melt. We do not dismiss the importance of these processes entirely; on the contrary, other geochemical and mineralogical aspects of the melt rocks require them, and condensation from the expanding ejecta cloud appears to best explain the primary Ir host-phase distribution in the fish clay, as well as the high Ir concentrations associated with spinel-bearing spheroids at the K/T boundary in the Pacific Ocean . If the ”relict” hypothesis is correct, micronuggets of other PGEs and alloys, not detected by our INAA screening, should also occur in the melt rocks. Possibly, the discrete host phases with lesser Ir masses are such alloys with subordinate Ir, rather than simply smaller, predominantly Ir-bearing particles. A CAI source for the relics would be consistent with either a comet or an asteroid K/T impact at Chicxulub. (Additional information contained in the original.)

Author

Breccia; Cretaceous-Tertiary Boundary; Ejecta; Geochemistry; Iridium; Meteorites; Projectiles; Meteoritic Composition; Meteorite Craters

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Characteristics of the Frood-Stobie Pseudo-Tachylyte Belt, Sudbury Impact Structure, Canada

Scott, R. G., New Brunswick Univ., Canada; Spray, J. G., New Brunswick Univ., Canada; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 51; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Frood-Stobie breccia belt is a subconcentric arc of pseudotachylyte, ranging from 0.1 to 0.5 km in width and 45 km in length, to the Sudbury Igneous Complex (SIC) in the South Range basement rocks of the 1.85-Ga Sudbury impact structure. The belt is best exposed to the east of the Copper Cliff radial offset, which intersects it. to the west, the belt is poorly exposed but is well expressed in regional aeromagnetic data as a 120 nT high. The belt consists of rounded, elongated breccia clasts and blocks of 2.0-Ga Huronian Supergroup metasedimentary and metavolcanic basement rocks, ranging in size from several millimeters to tens of meters. The pseudo-tachylyte matrix is a dark, fine-grained recrystallized frictional melt consisting of quartz, biotite, plagioclase, potassic feldspar, and ilmenite, along with minor pyrite and pyrrhotite. The biotites typically contain Cl, which, with other halogen-bearing minerals, is particularly evident in association with the ore deposits. Numerous inclusions of biotite and apatite are found within the quartz and feldspar grains. Zircons are ubiquitous in association with the biotite grains and provide an avenue for future U-Pb dating of the pseudotachylyte. The matrix appears annealed, with no melt glasses remaining. The pseudotachylyte is locally massive but is usually strongly foliated. This biotite foliation may represent a primary flow structure or a metamorphic foliation formed during Penokean (1.85 Ga) and/or Grenvillian (1.0 Ga) compression from the southeast . The belt hosts one of the world’s richest deposits of Ni-Cu-PGE ore, the Frood-Stobie mine complex, which has been in production for more than 100 years. Additionally, deposits at the Kirkwood mine at the eastern contact with the SIC, and at the Victoria mine at the western contact with the SIC, contribute to the considerable economic significance of the pseudotachylyte belt. These Ni-Cu deposits are associated with quartz diorite bodies that are typically hosted by the pseudotachylyte, both of which may have been injected into the pseudotachylyte from the lower levels of the SIC at an early stage of its differentiation. The ores are primarily composed of massive to disseminated chalcopyrite, pyrrhotite, and pentlandite. Unusual Pd-bearing minerals such as michenerite (PdBiTe) and froodite (PdBi2) have been found in ore samples from the Frood mine. The Frood-Stobie belt is thought to be derived from high strain-rate (>1 m/s) frictional comminution and melting of the country lithologies during collapse of the transient cavity and subsequent slumping of the crater walls. Structural studies of Penokean and Grenvillian thrusting from the southeast indicate

that the exposed rocks of the belt have been uplifted 5-6 km and subsequently eroded . This contrasts with pseudotachylyte belts in the North Range, which are considerably thinner in width and less tectonically deformed, but are nevertheless indicative of multiring basinal formation by high-speed slip along concentric fault surfaces.
Author
Breccia; Lithology; Rocks; Meteorite Craters; Ejecta; Mineral Deposits

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Assessing Impact Trajectory in the Geologic Record
Schultz, P. H., Brown Univ., USA; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 51-52; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A paradigm exists that impact craters must be largely circular due to the overall symmetry of the intense expanding shock at large distances from the point of impact. This paradigm is reinforced by a cursory examination of impact craters on other planets, by terrestrial field experience, and by laboratory impact experiments in particulate targets. With this paradigm, most observed asymmetries are attributed to either differential erosion, or overprinting by the regional structure. Only the lowest-angle impacts producing obviously elongated shapes, therefore are easily recognized. Here it is proposed that impact angles as high as 50 degrees from the horizontal can produce diagnostic asymmetries in primary patterns of deformation and modification that hold clues for impact trajectory. Most terrestrial impacts are heavily eroded; hence, correlations between asymmetries in ejecta deposits and crater structure are rarely possible. Consequently, the planetary impact record and laboratory experiments provide the best clues for recognizing trajectory effects. These clues include the following features for complex craters and basins: uprange offset of the central uplift (peak, peak-ring, or gravity anomaly) related to the maximum transient depth; breached or elongated central peak or ring reflecting the compression stage; greater central peak diameter ring relative to crater diameter (for a given diameter); pear-shaped crater outline; deep rim faults uprange (shallow downrange); maximum structural rim uplift perpendicular to the trajectory; maximum shock effects at depth perpendicular to the trajectory; minimal shock effects uprange; reduced shock at depth downrange; faults and fractures at depth parallel to trajectory downrange; enhanced shear deformation at depth downrange; and enhanced impactor signature in downrange melts. These general signatures of trajectory apply for impact angles between 15 deg. and 30 deg. but some elements persist to higher angles. They also become more evident with increasing crater size due to reduced cratering efficiency at large scales. All signatures, however, can be clearly documented for craters from 15 to is greater than 1000 km diameter on the Moon, Mars, and Venus, where the preserved distribution of ejecta allows corroborating evidence . Moreover, all signatures can be documented in much smaller-scale hypervelocity laboratory experiments under controlled conditions that trace the distribution of peak pressures. Because many terrestrial impact structures have been extensively eroded below the crater rim and well into the central peak, asymmetries in crater outline comparable to preserved analogs on planetary surfaces are lost. The outer limits of impact-induced failure near the surface are not the same as at depth. Near-surface failure is controlled by tensile strength following passage of the shock. Tensile strength is not only weaker than compressive strength but also depends on strain rate, Consequently, near-surface failure should extend well beyond the excavation rim and should increase with crater size beyond expectations for constant strength versus gravity scaling. This strain-rate dependence complicates derivation of impactor size from crater diameter and contributes to the apparent shallowing of craters with scale. Because the central uplift reflects the conditions of impactor penetration, it provides a more reliable indicator of impactor size. Such processes contribute to the overall symmetry of the outer boundary of most craters, but asymmetry of the central structure preserves the fingerprint of the trajectory. The Chicxulub impact is believed to exhibit evidence for an impact trajectory from the southeast at 20-30 deg. It is suggested, however, that the Sierra Madera, Clearwater east-west lakes, and Vredefort impact structures also exhibit evidence for impact angles is less than 45 deg. The Sierra Madera (Texas) structure is a heavily eroded structure (about 13 km diameter) that exhibits four key signatures: an elongated central uplift indicative of a northwest-southeast impact; maximum shock effects perpendicular to the elongated uplift (expressed by the outer limit of shatter cones); offset placement of the uplift to the northwest in this zone; and breccia dikes parallel to the uplift trend. The Vredefort Structure also exhibits structural, gravitational, and magnetic asymmetries that are often attributed to preexisting or postimpact faulting. Nevertheless, the striking similarity with other, even larger oblique impact structures on the Moon should at least raise the possibility that its pear-shaped outline is an expression of trajectory. Such a proposal may help explain its enigmatic shock record.
Author
Trajectories; Meteorites; Ejecta

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Shock Attenuation and Breccia Formation at a Complex Impact Structure: Slate Islands, Northern Lake Superior, Canada

Sharpton, V. L., Lunar and Planetary Inst., USA; Dressler, B. O., Lunar and Planetary Inst., USA; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 52-53; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Slate Islands archipelago, located about 10 km south of Terrace Bay, Ontario, represent a 7-8 km diameter central uplift of a 30-32 km complex impact structure. Recent Ar-40-Ar39 analyses indicate that the structure is about 450 m.y. old. Archean and proterozoic felsic and mafic intrusive and extrusive rocks and metasediments constitute the target assemblage. Shatter cones, strong brecciation, and shock metamorphic mineral deformation demonstrate that the structure was formed as the result of a comet or asteroid impact. Impact-generated breccias account for about 15-25% of the islands: (1) pseudotachylites: These fine-grained-to-aphanitic, inclusion-poor veinlets have sharp host-rock contacts and dendritic apophyses; field relationships indicate that these breccias are some of the earliest formed, probably during the compressional stage of the impact process, and they appear to be relatively scarce; (2) polymict, clastic matrix breccias: these occur as dikes and irregularly shaped bodies, a few centimeters to is greater than 10 m wide; they have sharp contacts with the host rocks and were formed during the decompression stage of the impact process, somewhat later than the pseudotachylites; they cut across pseudotachylite veins and contain inclusions of them; this is the most common type of Slate Islands breccia; (3) monomict, autoclastic breccias: these have a shattered appearance but retain the basic target stratigraphy and structural elements; these breccias have transitional host-rock contacts and appear to be confined primarily to exposures on the outlying islands of the archipelago; fragments of polymictic clastic matrix breccia dikes found within some autoclastic breccias indicate that generation of these deposits extended into the later stages of the impact process; and (4) allogenic breccia deposits: these consist of vestiges of extensive polyrnict clastic matrix breccia overlying the shocked parautochthonous basement. Some deposits are suevitic and show evidence of having once contained glass as well as highly shocked rock fragments; others, however, showing no conspicuous evidence of altered glass, may be more akin to bunte breccia. These deposits constrain the level of erosion to only a few hundred meters at most, considerably less than previous estimates. Shatter cones occur on all islands of the archipelago, indicating that all target rocks on the islands experienced minimum shock pressures of 4 +/- 2 GPa. Other shock metamorphic features are kink bands in micas, planar microstructures in quartz and feldspar, minor maskelynite, and impact glass. Based on the petrography of more than 100 thin sections of quartz-bearing target rocks and the correlation of the frequency of low-index planar deformation features in quartz with results from shock recovery experiments, the peak shock pressures experienced by individual samples were estimated. In general there is a decrease in shock pressure from about 20 to 25 GPa near east-central Patterson Island, the largest and central island of the archipelago, to about 5-10 GPa at the eastern shore of this island. The shock attenuation gradient is about 4.5 GPa/km across the island group. The shock level distribution, however, has a roughly circular plan only over the western part of the archipelago, consistent with the recently revised placement of the crater center. A relatively large area of southeastern Patterson Island is characterized by shock levels below those needed to produce planar deformation features. These results are not consistent with the conventional view that shock levels across the uplifted basement near the center of a complex crater accurately preserve the systematic radial attenuation of the shock wave from a point source. Instead, differential movement of large target blocks during the uplift has imparted a decidedly irregular and fragmented pattern to the recorded shock pressures across the exposed central portion of this crater. The orientation of planar deformation features in quartz was studied in one oriented chert sample, and it appears to be independent of the shock-wave direction, suggesting that the crystal structure exerts the primary control on planar microstructure development. Author

Breccia; Meteorite Craters; Meteoritic Damage; Metamorphism (Geology)

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Impact Deposits from the Southern Inner Flank of the Chicxulub Impact Basin

Sharpton, V. L., Lunar and Planetary Inst., USA; Marin, L. E., Ciudad Univ., Mexico; Corrigan, C. M., Michigan State Univ., USA; Dressler, B. O., Lunar and Planetary Inst., USA; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 53-54; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Chicxulub impact basin formed in a mixed target sequence consisting of 2-3 km of interbedded carbonates and evaporites of Cretaceous age overlying Pan-African granites and gneisses with minor sands and shales. During an UNAM-led campaign of shallow drilling along the southern flank of the buried basin, about 1000 m of impact breccia and melt-rock samples were extracted from three wells located 110-150 km from the center. The U5 well (about 110 km) intercepted an apparently complete impact sequence at a depth of about 330 m. This sequence consists of a 30-40-m-thick altered melt-rock unit overlying crater suevite. Within the melt-rock unit are infrequent pebble-to-cobble-sized clasts of highly shocked and partially melted basement, as well as weakly shocked platform rocks. Major-element chemistry of the matrix materials within the suevite indicates that this unit is

strongly enriched in silicate basement protolith. The contribution from the overlying platform sediments, either as a primary component or a local component added during emplacement, is constrained to be is less than 30% of the total mass. Centimeter-scale clasts of partially altered to unaltered melt rock and decimeter-to-meter-scale highly shocked basement clasts; are found throughout the cored interval. Melt clasts are the most abundant clast type near the top of the suevite. Coring was terminated (T.D. = 503 m) in suevite. The U7 well (about 125 km, 702 m T.D.) penetrated a thick sequence of suevite, but no melt rock was recovered. Instead, an unconformity separates the truncated upper part of the suevite deposit from the overlying post-crater sediments. Core inspections and major-element chemistry indicate that a major change in the breccia characteristics occurs at a depth of 375-578 m Breccia samples below this boundary have considerably fewer and smaller crystalline rock clasts, virtually no melt clasts, and a matrix dominated by protolith derived from the platform sequence. In these ways, this lower breccia is analogous to bunte breccia from the Ries Crater. Below about 375 m, the breccia sequence is interrupted by 10-50 m thick zones of tilted and disrupted Cretaceous limestone and dolomite. The jumbled nature of these blocks indicates that they represent large clasts incorporated within the breccia-like deposits, either as spall from the excavation cavity or as large local blocks disrupted and mobilized during ejecta emplacement. Drill core U6 (about 150 km; 700 m T.D.) revealed even more severe indications of erosion: The suevite unit is completely absent and the uppermost impact unit is an anhydrite-dolomite bunte breccia similar to that observed at similar distances in Pemex wells. Prior to impact, the region was covered by a shallow sea probably no deeper than about 50 m, and the rim and ejecta units were subjected to subaerial erosion and reworking. Well stratigraphy suggests that, immediately after the impact event, there was over 400 m of total stratigraphic relief from U5 to U6, with the top of the U5 impact sequence about 150 m below the K/T sea level (approximated by the unconformity) and the preerosional top of the U6 sequence about 350 m above sea level. This paleobathymetry accounts for the preservation of an apparently complete sequence of impact units at U5 but not in wells located at greater distances. Furthermore, the zones of reworked suevite above the impact units at U5 indicate that erosion of more distal rim deposits continued well into the Eocene. All these observations affirm that, prior to its erosion, the topographic rim crest of the Chicxulub impact basin was outside U7, and not inside U5 as would be the case if Chicxulub were is less than 200 km in diameter. (Additional information is contained in the original.)
Author
Breccia; Ejecta; Impact Melts; Meteorite Craters; Stratigraphy; Topography; Meteoritic Damage; Geochronology

20000031504 Geological Survey of Czech Republic, Prague, Czech Republic
Distortion Indexes and Other Structural Parameters as a Measure of Degree of Shock Metamorphism in Quartz
Skala, R., Geological Survey of Czech Republic, Czech Republic; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 54-55; In English; See also 20000031409
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As the most important rock-forming mineral and an important material in technology, quartz has been subjected to many studies in mineralogy and material science. Existing studies of quartz properties and behavior cover almost every aspect concerning this phase. Since quartz is one of the really ubiquitous minerals on Earth, and there are only a small number of terrestrial impact structures where this phase is not present, it is understandable why quartz was selected as an indicator of shock metamorphism in rocks. Many methods were used to study quartz grains to reveal fingerprints of shock comminution. Recently, transmission electron microscopy (TEM) and NMR spectroscopy have been the most popular examination methods. Research using TEM in some cases has even indicated that previous optical studies describing PDFs had found a kind of optical discontinuity, which, however, had nothing to do with impact metamorphism (structures Sevetin, Susice, and Azuara). Powerful X-ray diffraction methods were often forgotten in these studies although they could have provided valuable data on a relatively limited amount of material, mainly in the lower-pressure range where the lattice defects are not so pronounced. A number of papers have dealt with static compression studies of quartz using single-crystal X-ray diffraction methods. The aim of this abstract is to show how Rietveld crystal structure refinements of naturally shocked quartz corresponds to observations of statically compressed material. For the study, quartz from the world-renowned Barringer (or Meteor) Crater in Arizona, U.S., was selected. Two samples expected to undergo different pressure histories were studied for mutual comparison. A weakly shocked specimen was collected at the crater rim, whereas the second specimen, corresponding to heavily shocked Coconino sandstone, was taken from the bottom of the crater and contained hyperbaric silica phases (coesite and stishovite) at low concentration. Both samples were crushed and ground in agate mortar in alcohol. The resulting powder was then placed on a Si wafer as the flat sample holder for diffractometric studies. Powder patterns for Rietveld crystal structure refinement were collected using Philips X'Pert PW3710-MPD system with PW 1830 X-ray generator and PW3020 goniometer in Bragg-Brentano reflecting arrangement with Cu-sealed tube and secondary graphite monochromator. High voltage was set to 40 kV and current was set to 40 mA. Step-scanned data were collected in the range 18-140 deg 2 theta with 0.01 deg2 theta step and 10-s exposure per step. The Rietveld program FullProf was used to fit selected general (scale factor, half-width parameters, background coefficients, PSF shape factor, and asymmetry) and crystal

structure parameters (unit- dimensions and fraction coordinates of Si and 0). The space group used for refinement was P3(sub 1) 21, and starting unit-cell parameters were adopted from Glinnemann et al. for quartz at ambient pressure. The structural data were then processed by program BONDSTR to calculate bond lengths and angles. These values were then used for the computation of distortion indices as defined in Glinnemann et al., tetrahedral tilt as in Grimm, quadratic elongation, and bond average variance as defined in Robinson et al. All these parameters were found to be dependent on static pressure during relevant experiments. I had expected that natural shock load, as in the case of samples collected at the Meteor Crater, would have the same influence on these parameters as static compression. However, this was not the case. Dynamically compressed quartz does not follow trends observed for a statically compressed phase in values c/a ratio, tilt angle, absolute values of Si-O-Si angle, O-to-O distance between tetrahedra, and tetrahedral Si-O distances. On the contrary, the same trend was observed for distortion indices DI(OTO) and DI(OO), but the values of indices were significantly higher than those in static compression experiments. Values of DI(TO) cannot be used because there is no apparent correlation between pressure and DI(TO). Results of this study show interesting behavior of quartz crystal structure on shock loading and should be repeated with a larger number of samples experiencing different impact histories to allow correlation between individual parameters and the expected pressure load. The calibration on experimentally shocked recovered material using single-crystal data would significantly contribute to the discussion of this topic and could provide the necessary calibration. When properly tested, the method described here could provide important insight into the compression process and how material like quartz can accommodate the changes induced by shock by distortion of their lattice. (Additional information is contained in the original.)
Author
Metamorphism (Geology); Meteorite Craters; Quartz; Phase Transformations; Meteoritic Damage

20000031505 Geological Survey of Czech Republic, Prague, Czech Republic
X-Ray Diffraction Study of Three Calcite-Rich Samples from the Kara Structure
Skala, R., Geological Survey of Czech Republic, Czech Republic; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 55-56; In English; See also 20000031409
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The Kara Crater is located on the Kara River, near the shore of the Kara Sea on the slopes of the Pai-Khoi ridge. The crater is developed in rocks of Proterozoic to paleozoic age (shales, limestones, diabases, etc.) and was formed about 67 Ma. The diameter of the crater was given as 120 km. The Kara Crater is located on the Kara River, near the shore of the Kara Sea on the slopes of the Pai-Khoi Ridge. The crater is developed in rocks of Proterozoic to Paleozoic age (shales, limestones, diabases, etc.) and was formed about 67 Ma. The diameter of the crater was recently given as 120 km. Eight samples from drill cores located within the Kara impact crater were studied. They came from suevites (six) and from shocked basement (two). All specimens were very fine grained, so optical microscopy appeared to be of limited use. Therefore, I examined all samples using powder X-ray diffiraction. Five of the eight specimens revealed significant admixtures of quartz, feldspars, and clay minerals, so they were rejected from further XRD research. Nevertheless, clasts from suevite (drill cores KA1 and SA1) and the sample from shocked basement (KHO) contained small or no quartz admixture and were subjected to detailed study. Powder samples were prepared and placed on Si wafers. Step-scanned diffraction data were collected using a Philips PW3710-MPD diffractometer with Cu-sealed tube in the range 15-145 deg. 2 theta with step width 0.02 deg. 2 theta and step duration of 8-12 s. Individual profile fitting has provided angular positions of reflections and their breadths and intensities. Profile breadths expressed as FWHM (in deg 2 theta) plotted against diffraction angle differentiate data sets very well. As expected, clasts from suevite where the shock degree is variable revealed different values of peak widths. Peak widths measured from material coming from heavily shocked crater basement were higher than those of one of the suevite clasts (KA-02) but lower than those observed for the other suevite material (KA-05). Therefore, it can be expected that samples KA05 and KA-06 underwent a shock event of a higher degree than did sample KA-02. Another aspect revealed from individual profile fitting was change of unit-cell parameters and volume. Unit-cell volumes follow generally accepted trends: the higher degree of impact metamorphism, the higher the cell volume, though volume calculated for KA-05 does not agree with expected degree of shock inferred from. other parameters. Intensities of peaks also change, the largest being a difference in intensity of 006 reflection. This large intensity is probably due to overlaps of 006 with 014, which is the highest peak at the diffraction pattern. In this case, the lower the 006 intensity, the higher expected impact-induced comminution. Rietveld analysis of the whole diffraction patterns provided crystal structure information. Oxygen fractional coordinate x (the only variable parameter in the calcite crystal structure) remains almost essentially the same. Small differences were met only in bond lengths Ca-0 and C-O within the crystal structure. The trend observed indicates shortening of Ca-0 bond length with increasing expected shock load while the length of C-0 bond becomes higher. Based on all observed

parameters, it can be concluded that the most intense impact metamorphism is recorded in samples KA-05 (clast from suevite) and KA-06 (crater basement). (Additional information is contained in the original.)
Author
Calcite; Meteorite Craters; Meteoritic Damage; Metamorphism (Geology); Phase Transformations; Impact

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Shock-Induced Effects in Malmian Limestones from the Steinheim Crater Revealed by X-Ray Powder Diffraction Study
Skala, R., National Museum, Czech Republic; Jakes, P., Charles Univ., Prague, Czechoslovakia; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 56; In English; See also 20000031409
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The goal of the study was to show the effects of impact metamorphism on carbonate sedimentary rocks of the Steinheim Crater as revealed in X-ray Powder diffraction data. The Steinheim Crater in Southern Germany lies in carbonate sedimentary lithologies of the Swabian Alb. The diameter of the structure varies between 3.1 and 3.8 km. The central feature of the crater is about 900 m in diameter and roughly 50 m high. Rocks occurring in the crater vicinity are Upper Malmian limestones and marls. Limestones and marls of lower Malm and clays, limestones, and sandstones of Dogger are found in the central hill. Limestones found both within and outside the crater are generally very fine grained. The use of optical microscopy thus does not allow for the indisputable recognition of impact-induced features in calcite grains. On the other hand, powder diffraction patterns can clearly record both dynamic and static pressure-induced defects in many types of target material. We have chosen unshocked Upper Malmian limestone from Heidenheim (about 6 km east of the crater center) as a reference material (ST-02), and country rocks from crater rim at Burgstall (ST-03, ST-12, ST-13), limestone breccia (ST-10), and samples containing shatter cones found near Steinheim on the slopes of the crater central feature (ST-05) as typical representatives of shocked lithology. Our attention was focused on profile shapes that are generally sensitive to any change in size of crystallites and/or lattice strain. Unit-cell parameters as a measure of shift of position of individual reflections were also refined by ZDS software. Rock samples were prepared in a routine way for the powder diffraction study. Diffraction data were collected using a Philips PW3710-MPD powder diffractometer in Bragg-Brentano reflecting geometry equipped with a proportional counter and graphite secondary monochromator. Copper radiation was utilized (PWI 830 high-voltage generator operated at 40 kV and 40 mA). The range of step-scanning was 15-145 deg. 2 theta with step size 0.02 deg 2 theta) and exposure between 7 and 12 s per step for individual samples. The most apparent feature of all collected powder patterns was increasing deformation of reflections shape with more violent expected pressure comminution. Generally, the higher expected shock metamorphism, the lower and broader reflections were observed. Another effect easily observable in the patterns was the progressive disappearance of reflection 006 at about 31.5020 CuK alpha due to its overlapping by tails of 104 reflection corresponding to the most intense peak in diffraction patterns and significant decrease of possibility to distinguish reflection 024 in clusters of three reflections roughly between 47 and 49020 CuK alpha. Mutual intensity ratios thus dramatically change, but this striking difference cannot be used uncritically because of the possible variation in chemistry that must be taken into account before any serious conclusions can be made. There is a strong tendency for increase of absolute FWHM value for particular reflections in certain powder patterns with higher expected shock load. This tendency is fully compatible with observations for quartz published by Skila. Unit-cell volumes follow trends found in, e.g., shocked quartz (i.e., they become higher with more severe expected impact treatment of the sample). Nevertheless, overall differences are not so pronounced as in the case of FWHM's. X-ray powder diffraction study thus has proved its usefulness for research of this type of target material, and the study of reflection broadening has clearly indicated the way strong shock-induced effects can be found in calcite-bearing material. (Additional information is contained in the original)
Author
Lithology; Metamorphism (Geology); Impact Damage; Meteorite Craters; Cratering; Ejecta

20000031507 Geological Survey of Canada, Ottawa, Ontario Canada
Characterization of Terrestrial Impact Structures by Radarsat
Smith, S. K., Geological Survey of Canada, Canada; Grieve, R. A. F., Geological Survey of Canada, Canada; Harris, J., Geological Survey of Canada, Canada; Lamontagne, M., Geological Survey of Canada, Canada; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 56-57; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We have used synoptic RADARSAT synthetic aperture radar (SAR) to aid in the basic characterizations of a select number terrestrial impact structures as part of RADARSAT ADRO project 122. In addition to RADARSAT, we have employed other SAR (ERS-1, airborne) digital topographic (1:50,000, 1:250,000) and other data (including LANDSAT) where possible to compensate for look-direction bias in an individual SAR image and provide maximum enhancement of structural features. RADARSAT data

delineate lithological units in only a few cases. For example, the principal outcrops of the massive impact melt rocks (tagamites) are evident at Popigai, as is the outcrop of the impact melt sheet at Manicouagan. The expression of these lithological units is much less or not at all evident in satellite data of optical wavelengths such as LANDSAT. In terms of structural analysis and based on past experience with ERS-1 data, we have focused on structures that have been subject to glaciation, since RADARSAT tends to accentuate regional and impact-related fracture patterns. A general characteristic in the RADARSAT data is the modification of regional fracture trends by the impact structure. For example, at the Clearwater Lake structures, the dominating east-west regional fracture pattern is modified to more concentric and radial patterns as the structures are approached. These are exterior to existing estimates of the original rim diameters. At more deeply eroded structures, e.g., Mistasin and Charlevoix, such an exterior fracture halo and modification to the regional structure is less obvious. What is apparent, however, is the essentially complete cessation of regional Fracture patterns within the estimated original rim, with the radar texture within the estimated rim area being distinct from that in the exterior. This is most likely due to impact-induced fracturing in the original crater floor being isotropic with respect to direction and overwhelming any preexisting regional fracture pattern. Charlevoix is the most seismically active area of the St. Lawrence Rift system, and we have used slope analysis from a 1:50,000 DEM to identify subtle topographic and drainage features. The interpreted features are being correlated with lineament analysis from SAR imagery and classified according to their nature as (active) faults, possible faults, and fractures to assess the contribution of impact-related structural features to local seismic activity. At the tectonically deformed Sudbury Structure, the imagery is complicated by 1.85 Ga of postimpact geological history. Features such as the Onaping Fault Swarm are clearly evident, as are post-impact diabase dikes. There does, however, appear to be a reduction in the expression of regional fracturing, which is believed to be related to the impact structure, north and west of the Sudbury Igneous Complex. Concentric (ring?) fractures defined from LANDSAT imagery are not apparent in the SAR imagery. Exterior concentric fracturing, such as that observed at the Clearwater Lake structures, is highly evident in the SAR imagery at the younger and smaller (D = 7.5 km) Wanapitei structure, which is superimposed on the Sudbury Structure.

Author

Topography; Image Analysis; Meteorite Craters; Projectile Cratering

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Crustal-Scale Structural Geometries of the Chicxulub Impact from British Institutions Reflection Profiling Syndicate Seismic Reflection Profiles

Snyder, D. B., British Institutions' Reflection Profiling Syndicate, UK; Hobbs, R. W., British Institutions' Reflection Profiling Syndicate, UK; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 57; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The deep seismic reflection profiles acquired during the British Institutions Reflection Profiling Syndicate (BIRPS) survey off the north coast of Yucatan in September-October 1996 have clarified the geometries of several major features of the Chicxulub impact structure. The most prominent reflector observed on each of the four 150-200-km-long radial profiles are related to a Jurassic-Cretaceous stratum at 2-3 km depths and to the Moho at 30-35 km depths. The Mesozoic reflector appears relatively undisturbed throughout most of the Yucatan continental shelf, but becomes gently domed at about 120-150 km radial distance from the hypothesized "ground zero" of the Chicxulub impact. At a distance of 75-90 km, this reflector is strongly folded, contorted or faulted. At 70-90 km it is downdropped 4 km, and at 40-45 km it disappears completely. If the downdropped sections are crudely restored to the regional and shallower level, a semicircular hole in this early Cretaceous anhydrite-carbonate stratigraphic section with a diameter of just less than 100 km is revealed. Impact-related structures appear at much greater radial distances (100-150 km) at shallower stratigraphic levels within the Mesozoic section. A layer with more chaotic reflectivity, interpreted as impact breccia that includes significant amounts of melt throughout separates the Cretaceous and Tertiary sedimentary sequences out to radial distances of 100-125 km. In parts of the central region of the impact structure this more chaotic seismic layer is at least 5 km thick. Near it upper boundary it contains several secondary impactors with diameters of several kilometers and Tertiary sedimentary units draped over their top surfaces. The lower crust is generally very reflective throughout the survey area at depths greater than 20 km. The base of prominent reflectivity occurs at 30 km, except beneath the impact structure, where it deepens to 32-35 km levels. The reflective lower crust is thus generally thicker beneath the impact structure. Individual reflections of bands of reflectivity are continuous for several to tens of kilometers, and these deepen or shallow gradually, suggestive of folding or flow rather than of brittle faulting. The upper crust is generally less reflective except for a few prominent reflectors that dip at about 30 degrees toward the center of the impact structure. One of these reflectors projects to the surface at a radial distance of about 96 km and offsets the Mesozoic strata by about 250 m with a normal sense of offset. Another reflector projects to the surface at 130 km where the doming of the Mesozoic strata described above suggests a reverse "blind thrust" sense of displacement. A third set of dipping reflectors occurs beneath the interior of the impact structure and these project up from 25 km depth toward the downdropped blocks of the Mesozoic strata. These dipping reflectors within the crystalline

basement probably represent shear zones with their reflectivity possibly enhanced by intrusions. If these shears were active during the impact or during the collapse phase, these intrusions could be related to melts generated deep in the crust by the impact. Author

Stratigraphy; Meteorite Craters; Cratering; Meteoritic Damage; Impact Damage; Ejecta

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New Types of Fault Behavior Associated with Hypervelocity Impact

Spray, J. G., New Brunswick Univ., Canada; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 57-57; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The investigation of selected terrestrial impact structures reveals that two distinct varieties of large displacement faults can develop in response to hypervelocity impact. The first is characterized by large displacement unidirectional slip (maximal offset) occurring during a single slip event at seismogenic velocity (>1 m/s). This is referred to as a superfault. Superfaults can facilitate transient cavity collapse and the general modification of impact structures. This can lead to the formation of ten-aces as well as the development of more distal ring features. These are essentially gravity-driven faults that undergo unconstrained (free surface) dip-slip or reverse-slip movement. Considerable disruption of stratigraphic sequences can occur due to the large offsets realized. The second type of fault is characterized by large displacement, oscillatory slip (minimal offset) occurring during a single event at seismogenic velocity (> 1 m/s). This is referred to as a ”vibrafault”. The unusual feature of a vibrafault is the virtual lack of offset. However, the total effective displacement can be significant depending on the frequency and duration of oscillation. Vibrafaults are probably activated during shock-wave propagation and acoustic dissipation. Additive interference of shock and/or sound waves may lead to the development of discrete zones of oscillatory slip. Vibrafaults therefore predate superfaults, though the latter may evolve from vibrafaults in time. Both fault types result in total displacements estimated to range from 10(exp 2) to 10(exp 4) m per single event, with the potential for massive energy release at the moving interface. Field evidence and calculation indicate that the bulk of the energy is converted to heat through frictional processes. Typically, this leads to the generation of giant friction melt bodies (pseudotachylyte), as can be observed at Sudbury and Vredefort. These new fault types offer explanations for the development of certain unusual features in impact structures. For example, superfaults can facilitate the penetration of impact melt deep into footwall rocks, as is the case for the economically important Offset Dikes at Sudbury. Vibrafaults; can account for the development of thick pseudotachylyte bodies despite the lack of offset documented across such zones.

Author

Displacement; Hypervelocity Impact; Geological Faults; Crustal Fractures; Impact Damage; Fissures (Geology)

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Cretaceous-Teritary Ejecta Layer: A Case Study for Locating Source Craters and Implications for Ejecta Scaling

Stansberry, J. A., Lowell Observatory, USA; Hildebrand, A. R., Geological Survey of Canada, Canada; Collins, P. A., Massachusetts Inst. of Tech., USA; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 58-59; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We used measurements of the thickness of the K/T ejecta blanket in the Caribbean, Central American, and North American regions to determine statistically the size and location of the K/T source crater While the source of the K/T deposit is perhaps less controversial now than it has been in the past, the ejecta blanket provides a good opportunity to test ejecta scaling relations and explore the possibility of using other ejecta blankets as a means of ”remotely sensing” undiscovered terrestrial source craters. Our method of analysis is based solely on a set of measurements of ejecta-blanket thickness and the selection of a relationship between ejecta thickness, crater size, and distance to the crater . Given these, it is straightforward to calculate the chi-square statistic for any given hypothetical location and size of the source crater. A measure of goodness-of-fit between a dataset and a model for that dataset is chi-square = 1/N,sum of (t(sub i) - m(sub i)0(exp 2))/sigma(sub i)) (where N is the number of thickness measurements, t(sub i) is the measured thickness at the i-th location, m(sub i) is the model value for the thickness at the i-th location, determined from the scaling relation and the guess for the crater location and size, and a. is the uncertainty in the thickness measurement). For a model that describes the data well, Chi-square approaches a value of unity. Models that do not fit as well result in larger values of chi-square. We established a geographic grid of hypothetical source-crater locations and computed model thickness values for craters at each location on the grid. These model thicknesses were then compared with the measured thicknesses in order to compute chi-square, resulting in a map of chi-square vs. crater location. We also varied our guess for the crater size at each location, so that we ended up with a family of chi-square maps consisting of one map for each crater size we used. Figures show two contour maps of log-10(chi-square) VS. latitude and longitude for a region around the Caribbean. The chi-square values are based on thickness data (triangular symbols) for the K/T ejecta blanket (for proximal sites at Beloc, Haiti, DSDP 540, Yucatan Channel, and Mimbral, Mexico, plus distal sites located to the northwest and northeast) and two estimates, 180 km and 295 km, for the

diameter of the K/T source crater. The map based on the 180-km crater size has an chi-square minimum (with a value of 0.99) that coincides almost exactly with the location of Chicxulub. The heavy contour line shows the region where there is a 90% likelihood, statistically speaking, of finding the source crater for the dataset, if the source crater has a diameter of 180 km. The size of the 90% likelihood region, which is bounded by the heavy contour at Chi-square = 1.65, is related to the size of the uncertainty in the thickness measurements, which we chose to be 50% of the measured value based on the observed thickness variability in outcrop. The map based on an assumed 295 km diameter for the source crater has a chi-square minimum of 1.3, located over northwest South America. The 90% likelihood region is bounded by the dashed contour at chi-square = 1.9 and encompasses a huge region of northern South America extending westward into the Pacific Basin. Using additional ejecta localities reduces the regions of high probabilities, particularly if additional localities are well separated from previously incorporated data and lie in radial directions previously unconstrained. With a view toward using our method for finding source craters, we will present results evaluating its sensitivity to sampling effects and to uncertainties and biases in thickness measurements. (Additional information is contained in the original.)
Author
Ejecta; Meteorite Craters; Impact Damage; Cratering; Hypervelocity Impact; Meteorite Collisions; Mathematical Models; Goodness of Fit

20000031511 Oslo Univ., Dept. of Geology, Norway
Seismic Analysis of the Mjolnir Impact Structure, Barents Sea
Tsikalas, F., Oslo Univ., Norway; Gudlaugsson, S. T., Oslo Univ., Norway; Faleide, J. I., Oslo Univ., Norway; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 59; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A dense grid of high-resolution single-channel, shallow multichannel, and conventional multichannel seismic-reflection profiles defines in detail the structural and stratigraphic framework of the impact-induced disturbance and postimpact evolution of the Mjolnir Structure. Excellent seismic images of the well-preserved, 40-km-diameter structure reveal that the primary impact-induced deformation is bounded on top by a discernible structural relief. At this level, the structure exhibits a distinct radial zonation pattern comprising a 12-km-wide complex outer zone, including a marginal fault zone and a modest peak ring, a 4-km-wide annular depression, and an 8-km-diameter uplifted central high. Furthermore, we show that the key features of the Mjolnir Structure are similar to those found at the majority of large terrestrial complex craters. Such features include sharp rim faults with a cumulative throw of about 150 m that separate highly deformed strata within the crater from intact platform strata, and a 45-180-m-thick seismic unit, formed during impact, characterized by disturbed and incoherent reflectivity patterns and confined by prominent fault-blocks and the postimpact strata. The seismic data also provide evidence of crater-influenced sedimentation, as well as extensive secondary postimpact deformation expressed by structural reactivation and differential subsidence. Rcconstruction of the original crater relief brings out an initially subtle structure with only about30-40 m average residual depth, demonstrating substantial enhancement of structural features by the post-impact burial and deformation. A large degree of gravitational collapse explains much of the shallow depth of the Mjolnir Structure. However, volume balance analysis shows that additional infilling by other processes is required to fully explain the present relief. The extensive postimpact deformation is closely related to lateral changes in physical properties, such as porosity and compactibility, within the impact-affected rock volume, triggered by prograding postimpact sediments.
Author
Meteorite Craters; Impact Damage; Seismology; Meteoritic Damage; Projectile Cratering; Hypervelocity Impact

20000031512 Academy of Sciences (USSR), Inst. for Dynamics of Geospheres, Moscow, USSR
On Formation Mechanism of Flattened Subsurface Fracture Zone in Meteorite Craters: Results of High-Explosive Laboratory Experiments
Tsvetkov, V. M., Academy of Sciences (USSR), USSR; Zenchenko, Y. V., Academy of Sciences (USSR), USSR; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 59-60; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The study of well-preserved craters on the Earth's surface (e. g., Kaali, Estonia [11, and Meteor Crater, U.S.) demonstrates a presence of an approximately hemispherical fractured zone under the crater floor. In addition, there is a flattened subsurface fractured zone under the rim, with a depth that decreases from the crater center. In the geophysical model of the meteorite crater offered in Dabizha and Ivanov, the radius of the subsurface fracture zone is assumed to be equal to two crater radii vs. one crater radius of the hemispherical part of the fracture zone. Such a fracture-zone configuration contradicts the picture of shock pressure isobars; those are approximately hemispherical in all the half-space, except for a thin region near the free surface. In Dabizha and Ivanov, it was suggested that fracture-zone geometry is the result of secondary fragmentation during crater excavation, enhanced

by cratering flow peculiarities. This suggestion has a serious drawback because secondary fragmentation takes place in the inner part of the fracture zone rather than at its periphery. High-explosive laboratory modeling of the cratering process allowed us to observe all features of the fracturing process, including subsurface fracture-zone formation. We used a pine rosin as a model material. Rosin is a brittle material having the following properties: density, 1.08 g/cubic-centimeter longitudinal wave velocity, 2470 m/s, and unconfined compressive strength, 20 MPa. The fracturing process was registered by optical technique due to the relative transparency of rosin. Spherical charges of PETN with R = 4 mm and mass = 0.38 g were used as the explosive. Successive positions of the fracture front are shown. In region A, the fracture front is approximately spherical. Its velocity equals 1200 m/s at distances less than 10 R and 960 m/s in the range of 10-15R. At larger distances, the fracture front decays. In region B, the fracture front represents a conical surface with a constant angle between its element and free surface. The velocity of the conical front is 960 m/s in the entire region B. Its elements terminate under the free surface. Immediately adjacent to the surface, zone C fragmentation is due to spall phenomena. It was shown that value 960 m/s is the maximum velocity of tension fractures propagation; the conical front propagates with maximum tension-cracks velocity. It is obvious that the conical fracture-front appearance is the result of stress-wave-free boundary interaction. In general, the final fracture zone form that is visible in the experimental sample section repeats the fracture-front configuration. Its horizontal radius equals four crater radii, while its depth equals two radii. Thus, experimental results show that both subsurface and hemispherical fracture-zones formation take place simultaneously and precede crater formation. The horizontal-to-vertical dimensions of the fracture-zone ratio are the same as that of Earth's craters. A discrepancy between laboratory and natural fracture-zone dimensions with respect to crater diameter may be caused by the relatively low strength of rosin vs. rocks on one hand and by rock properties alteration due to geological processes on the other.

Author

Fracturing; Fragmentation; Geophysics; Meteorite Craters; Meteoritic Damage; Projectile Cratering; Experiment Design

20000031513 Lunar and Planetary Inst., Houston, TX USA

Numerical Modeling of the Formation of Multiring Basins

Turtle, E. P., Lunar and Planetary Inst., USA; Melosh, H. J., Lunar and Planetary Inst., USA; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 60; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Among the different morphological types of impact structures are multiring basins, very large craters surrounded by one or more concentric rings with asymmetric topographic profiles. Recently it has been suggested that three terrestrial impact structures are possible multiring basins: Vredefort, Chicxulub, and Sudbury. While the morphology of multiring basins has been studied in some detail the processes that lead to their formations are relatively poorly understood, and a number of theories have been advanced to explain their formation. We are using finite element modeling to investigate the collapse and relaxation stage of impact crater formation with the specific intention of determining the mechanisms necessary to form concentric scarps external to the crater cavity. Starting with a uniform mesh, we form a transient crater using Maxwell's Z-model to predict which material will be ejected and the displacements of the unejected material due to excavation flow. For this research we have been using a transient crater 50 km in radius and 30 km deep; using scaling relations, this corresponds to a final crater comparable in size to the estimates that have been made for Sudbury, Chicxulub, and Vredefort. To model the collapse and modification of the transient crater, we are using the finite element code Tekton. Our model incorporates realistic power-law rheologies for the upper crustal rocks in the vicinity of the Vredefort structure in South Africa above a granitic lower crust that extends down to the Moho at a depth of 45.5 km. We included a low-viscosity layer of variable thickness and depth to investigate the theory Melosh and McKinnon developed to explain the formation of multiring basins. So, in essence, the mesh has two rheologies: the relatively low-viscosity Newtonian rheology of the low-viscosity layer and the stiffer power-law rheology of the surrounding material. We have run simulations for low-viscosity layers with thicknesses ranging from 14 to 42 km and depths (of the top of the layer) ranging from 7 to 49 km. For each simulation, we followed the evolution of the surface stress field external to the transient crater. For a shallow layer (top of layer at 7 km depth) of any thickness within our range, we found that the radial stresses are typically extensional and are sufficiently large (peak extensional stresses is greater than 1-3 kbar) to induce normal faulting in a thin layer. While the value of the maximum radial stress achieved is dependent on the thickness of the low-viscosity layer, its radius is insensitive to the thickness of the layer and does not shift significantly with time. Moreover, the maximum extensional stresses occur at a radius of roughly 100 km, which is consistent with the Square root of 2 spacing that has been observed for rings around numerous craters. For deeper low-viscosity layers (top of layer below 14 km depth) the stresses near the final crater rim become compressive as the thicker upper layer is flexed upward. A region of extensional radial stress lies just outside the region of compressive stress. Progressively deeper low-viscosity layers result in a decrease in magnitude of the extensional stresses and a slight outward migration of the location of the peak stress. Our results indicate that the presence of a low-viscosity layer is consistent with the formation of at least one external ring. For a shallow (top of layer at is less than 14 km depth) low-viscosity

layer of any thickness up to 42 km and a transient crater 50 km in radius, the peak extensional stress occurs at a radius of about 100 km. We will present these model results. We also plan to investigate how the addition of a fault or faults in the stiff upper layer affects the subsequent evolution of the stress field to explore conditions under which more than one ring could form. The significance of plastic and power-law rheologies will also be studied.
Author
Finite Element Method; Mathematical Models; Fracture Mechanics; Meteorite Craters; Meteoritic Damage; Projectile Cratering; Ring Structures

20000031514 Valter (A. A.), Kiev, Ukraine
Mineralogical, Geochemical, and Geological Data for the Interpretation of the Crater Base Structure of the Complex Terny Astrobleme, Krivoy Rog, Ukraine
Valter, A. A., Valter (A. A.), Ukraine; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 60-61; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The deeply eroded (H is greater than = 0.8 km) Terny astrobleme was formed in the rocks of the Krivoy Rog Fe formation and related banded Lower Proterozoic metamorphic rocks and granitoids. The present-day diameter of the structure is estimated to be 8 km, but the original diameter might have been twice as large. The diameter of the eroded central uplift is about 2.5 km. In the exploration and production of ores, the sinking of quarries (to 350 m deep), mines (to 1 km deep), and boreholes was performed within the astrobleme. The K-Ar age determination of glass impactites gave 280 +/- 10 Ma. Observations in the mines show that the monoclinal-occurrence rocks were crushed into blocks and overturned ”to be pulled up” into the uplift area. As the depth exceeds 1 km, the occurrence approaches the normal value. Numerous bodies of fine fragmented breccia that separate large blocks of rocks have a preferred orientation that corresponds to the tectonic plan of the region. This gives evidence of breccia zones formation along the weakest and strained planes of the massif The ferroginous glassy impactites near the center of the uplift are formed by the melting of ferroginous quartzites, shists, and Fe ores. Most of the impactide bodies are of complicated origin, formed by shock metamorphism, rock crushing, mixing of fragments varying in shock alteration, and, finally, secondary heating by gaseous fluids. In these impactites the condensation of the Fe-Cr-Ni phase with a composition approaching the eutectic one was found. The geochemical traces of the ”meteorite explosion cloud” were observed down to the deepest level of the glassy impactite occurrence (850 m): 2.4 ppb of Ir (x 60 enrichment), 86 ppm of Ni (x 40 enrichment), and ratios Ni/Co = 12 and Ir/Au = 2. The veins of alkaline silicate impactites in the western part of the uplift occur in the microgneisses shists of similar composition. These impactites exhibited no significant meteorite material contamination. The presence of impact diamond grains found in these veins shows that the impulse pressure is sufficient for silicate melting in the shock wave or rarefaction wave. The models of impactite formation and mass dynamics in the crater base are proposed. Because of its good exposure and the specific composition of the target rocks, the Terny astrobleme can be used as a standard in studies of large meteorite crater bases.
Author
Meteorite Craters; Ejecta; Meteoritic Damage; Projectile Cratering; Rocks

20000031515 Academy of Sciences (USSR), Inst. of Mineralogy and Petrography, Novosibirsk, USSR
On the Water Regime of Impactites in Large Astroblemes
Vishnevsky, S. A., Academy of Sciences (USSR), USSR; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 61; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Due to scarce data and limited sample selection (tektites or glasses from small craters in and regions), terrestrial impact melt rocks are usually characterized as extremely dry (on average is less than 0.05 wt % H2O) in what is considered a typical feature of impact glasses. However, imposing H2O contents are found (from data on petrology, gas chromatography, fluid inclusions, etc.) in impactites of the 100-km Popigai Crater localized in AR gneisses + PR-MZ sedimentary cover. A large (about 2000 cubic km) body of Popigai impact melt rocks consists of two petrographic groups (T1 and T2 tagamites and their suevitic equivalents, fragments of G1 and G2 glasses): very fine-/noncrystallized T1/G1 glasses, respectively, vs. ”coarse”/well-crystallized T2/G2 glasses. Such a distinction in melt crystallization is due to a different water content (”dry” T1-G1 rocks vs. ”Wet” T2-G2 rocks, with H20 wt% of 0.73 and 2.23 respectively) inherited by melt from target gneisses. Impact anatexis of gneisses is found in some water-rich T2 tagamites. Anatectic glass here (globules in rock matrix, borders and interstitial films in residual gneiss fragments) originated by shock-induced separation of Si, K, and H20 from source rocks at pressures 27-50 GPa and residual temperatures 700-1700C; Al and Ti were indifferent, but Fe, Ca, Mg, and Na were essentially lost in this process. As a result, an ”asid” (up to 77 wt% SiO), K-rich (up to 6 wt% K2O), and ”wet” (4.2-6.9 wt % H2O in fresh glasses) anatectic melt was formed prior to tagamite crystallization, possibly due to an extremely high rate of element diffusion in strongly excited rocks. Microsized (down to 0.1 mm) globules in the tagamite matrix may indicate their mixing up and, consequently, fast origin still in shock-load state (x is less than 1 s). Fresh leshatelierite and high-silica (87-95 wt% SiO2) glasses in Popigai impactites often contain various fluid inclusions,

including gas, gas-liquid, and entirely liquid. The liquid phase is a water. Dense water inclusions (rho = 0.7- 1.0 g/cubic cm at 20 C) in the suevite glasses indicate a high confining pressure (1.4-3.3 GPa) during quenching of the melt from 1900 C to subsolidus, state, which is explained by water buffer action providing relatively slow pressure release of shocked ”wet” rocks. Coesite growth from hot shock-disordered quartz should be stimulated by slow unloading. Postshock residual temperatures in target rocks (with liquid water content from 1.8-2.6 wt% in AR gneisses to 8-10 wt% in sedimentary cover and dislocation zones) should provide high pressures of water fluid. Estimates range from 2.7 to 1.4 GPa. for initial pressures of the fluid at 1400-6600 C in shocked target rocks at postcratering depths of 6-10 km beneath the surface at Popigai. This high-pressure, up-directed superheated fluid flow might help in the origin of central uplift (by expansion and local explosions), and could provide intensive pneumatolysis and chemical mass transport in crater formations. In particular, K-enrichment of impactites in some craters might be caused by this process. Given examples show that the water fluid was an important agent in large-scale cratering, shock metamorphism and postimpact evolution of the crater rocks. ”Dry” regimes may be common only for some highly dispersed/condensed impact glasses (tektites, microspherules, etc.).
Author
Glass; Impact Melts; Water; Projectile Cratering; Meteorite Craters; Impact Damage; Ejecta; Hypervelocity Impact; Metamorphism (Geology)

20000031516 Imperial Coll. of Science and Technology, Dept. of Geology, London, UK
Chicxulub Seismic Experiment: Overview and Size of the Transient Cavity
Warner, M., Imperial Coll. of Science and Technology, UK; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 61; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Chicxulub seismic experiment was designed to image the subsurface reflectivity and seismic velocity structure of the Chicxulub impact from the base of the tertiary section to the Moho and below. Our scientific objectives were to use these data, together with constraints provided by existing boreholes and potential field observations, to determine (1) the radial extent and morphology of the impact structure, (2) the diameter and depth of the transient and excavation cavities, (3) the position, depth and geometry of slumped blocks on the flanks of the structure, and the style of associated structural uplift at the center of the crater, (5) the variation in thickness of the crust across the crater, (6) the extent of the melt sheet, and (7) the degree of radial asymmetry of the major structural and morphological elements within the crater. Our broader objectives were to improve our understanding of the cratering process for large impact events and to constrain the environmental effects of the impact The quality of the data are such that we expect to meet all these objectives. Outside the central region of the crater, we image the preimpact Mesozoic stratigraphy as a sequence of bright, subhorizontal, layered reflectors at depths of about 1-4 km. These marker horizons enable us to map a series of large slumped blocks within the interior of the crater and hence delineate the inner edge of the collapsed transient cavity. This has an average diameter of about 85 km. We have restored these slumped blocks to their preimpact position, and have used the z-model with a value of z about 2.7 to determine the diameter of the transient cavity. This lies in the range 105-120 km when defined by the position of the transient rim uplift excluding any overlying ejecta. The diameter of the transient cavity, restored to original ground level, lies between 90 and 105 km and corresponds closely to the diameter of the excavated cavity. This is the value required to calculate volumes of material ejected or volatilized by the impact and hence has the most relevance to questions about environmental perturbation at the K/T boundary. The size of the transient cavity is toward the lower end of the range of values that have been previously suggested, and it is clear that some previously published estimates of the volumes of SO2 and CO2 released by the impact have been significantly too large.
Author
Meteorite Craters; Seismology; Meteoritic Damage; Projectile Cratering

20000031518 Alabama Univ., Dept. of Physics, Birmingham, AL USA
Examination of the Effects of Fireball Radiation on Material of the Ejecta Curtain
Wdowiak, T. J., Alabama Univ., USA; Arnoult, K. M., Alabama Univ., USA; Coltress, B. G. R., Alabama Univ., USA; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 63; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Although the radiation emitted by the ascending fireball would be intercepted by material of the ejecta curtain, examination of the consequences of this occurring seems to have escaped the attention of those who study impacts. For the terrestrial situation the effects could include dessication of ejecta while above the atmosphere, annealing of shock induced features of crystals such as quartz, which are considered to be indicators of an impact event, and perhaps even tektite formation through fission of ejecta material in ballistic flight above the atmosphere. The luminosity history of the fireball, on the basis of preliminary calculations, appears to be the most significant factor in evaluating the role of radiation in the impact event. If radiation heating of ejecta is to be significant, it would be expected that the process would be relatively insensitive to variations of parameters, and even simple

models for the luminosity history should be useful in the assessment of radiant heating. It is also obvious that the duration of the period of high luminosity of the fireball would have the greatest effect. Prior to the Comet Shoemaker-Levy 9 impact with Jupiter, Zahnle and MacLow attempted to predict the fireball luminosity history for a bolide impacting a thick H atmosphere. The situation for a terrestrial impact would be a different one because high opacity sources would not only arise from the impactor but also from the more abundant target rock. In addition, there is a likelihood that condensation of solids would slow the expansion of the fireball. We have generated a family of fireball luminosity histories and used this information to estimate the temperatures of in-flight test particles at the inner surface of the ejecta curtain. The results have been applied to the questions of annealing of shock-induced distortions in grains and fusion of clumps into tektites. The results of these calculations will be presented. In addition, an apparatus for radiant heating in a vacuum of test samples, including tektite material, has been constructed. The apparatus has the capability of an irradiance of 10,000 suns, which is a level of interest, as indicated by our preliminary calculations. The results of experiments carried out with the apparatus will be discussed.
Author
Ejecta; Radiant Heating; Radiation Effects; Impact Damage; Meteoritic Damage; Bolides; Atmospheric Entry; Atmospheric Heating; Meteorites; Luminosity

20000031520 NASA, Washington, DC USA
Cryptoblemes: A New Discovery with Major Economic Implications and Profound Changes to the Geologic Paradigm
Windolph, J., Jr., Geological Survey, USA; Sutton, J., NASA, USA; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 64-65; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Cryptoblemes are subtle impact shock signatures imprinted by cosmic debris on the crustal surfaces of lunar planetary bodes. These signatures constitute a complex cumulative overprinting of topographic, structural geophysical, and tectonic patterns that have a conspicuous radial centric multiringed symmetry. The geometry and distribution of cryptoblemes on Earth is comparable to the size and density of impact features on lunar planetary surfaces. Analysis of satellite imagery, sea-floor sonar, side-looking radar and aerial photographs of specific sites reveals new criteria for the identification and confirmation of impact-shock signatures. These criteria include joint and foliation patterns with asbestiform minerals, ribbon-quartz, spheroidal weathering, domal exfoliation, pencil shale, and shock spheres, which may originate from hydrocavitation of water-saturated sedimentary rocks. Cryptoblemes may also be associated with breccia pipes, sinkholes, buttes, mesas, and bogs, high-Rn anomalies, nodular concentrations, and earthquake epicenters. Major implications of cryptobleme identification include exploratory targeting of hydrocarbon and mineral deposits and the explanation of their origins. Analysis of known mineral deposits, structural traps and sedimentary basins show a direct correlation with cryptobleme patterns. Significant geologic paradigm shifts related to cryptoblemes include mountain building processes, structural orogenies, induced volcanism, earthquake origins, hydrocarbon diagenesis, formation mineral deposits, continental rifting, and plate movements, magnetic overprinting and local regional, and global geologic extinction and speciation patterns. Two figures provide a comparison between a multiring impact overprint in water and multiring cryptobleme in the U.S. basin range. (Additional information is contained in the original document).
Author
Crusts; Geophysics; Topography; Hypervelocity Impact; Meteorite Collisions; Meteoritic Damage; Projectile Cratering

20000031521 New Brunswick Univ., Dept. of Geology, Fredericton, New Brunswick Canada
Emplacement of the Hess Offset in the North Range of the Sudbury Impact Structure
Wood, C. R., New Brunswick Univ., Canada; Spray, J. G., New Brunswick Univ., Canada; Napoli, M., Inco Ltd., Canada; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 65; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Hess Offset dike is subconcentric to the Sudbury Igneous Complex (SIC) between 13 and 15 km to the north of it. The offset extends from at least as far west as Clear Lake, and as far east as the Foy Offset, for a total distance of about 23 km. The dike is up to 30 m wide and intermediate in composition. It appears to be vertical but may dip steeply to the south. The 1.85-Ga Sudbury Structure is superimposed on the Archean basements rock in the North Range to the north of the SIC and the Proterozoic supracrustal rocks (Huronian Supergroup) in the South Range to the south of the SIC. The highgrade Levack gneisses are exposed near the contact of the SIC in the North Range. North of the Hess Offset occur erosional remnants of the Huronian Supergroup. These outliers form a ringlike zone subconcentric to the SIC. In the Hess and Foy Offset area, these Huronian remnants lie about 12-17 km north of the SIC. To the east of the North Range in the Whistle-Parkin Offset area, the remnants lie only 3-4 km northeast of the SIC. These Huronian Outliers are considered to be a down-faulted ring graben, whereas the Levack Gneisses proximal to the SIC represent uplift. The Foy Offset is apparently displaced to the east, where it intersects the Hess Offset and changes in strike. The common association of the Hess Offset with Sudbury Breccia (pseudotachylyte) indicates that the Hess Offset delineates a

subconcentric fault system that defines part of the collapsed and modified northern margin of the transient cavity of the Sudbury Impact Structure. Pseudotachylyte occurs as discrete veins (up to 0.5 m wide and as mm to microscopic veinlets), which form a border zone of more cataclastic deformation that may or may not contain pseudotachylyte. The larger veins of pseudotachylyte are typically subparallel to the Hess Offset, whereas the finer veinlets of pseudotachylyte are more anastomosing and ubiquitous. Granite clasts containing pseudotachylyte veinlets have been found within larger pseudotachylyte veins, implying at least two phases of brecciation/slip. The contacts with the host rocks display varying degrees of brecciation. These range from relatively undeformed or relatively unaltered granitoids, gradational with discrete veins of pseudotachylyte along the margin, to more cataclastically deformed granite, with varying degrees of chilled margin against the contacts. Major, trace, and REE chemistry of selected Hess samples clearly indicates an affinity with the SIC. The primary mineralogy is quartz + plagioclase + pyroxene + homblende + biotite; opaque phases include pyrite, pyrrhotite, pentlandite, and chalcopyrite, with minor amounts of argentiferous pentlandite, michenerite, and hessite. The pyroxenes have been extensively altered to actinolite. Other secondary minerals include sphene, chlorite, biotite, and epidote.
Author
Rock Intrusions; Projectile Cratering; Meteorite Craters; Meteoritic Damage; Hypervelocity Impact; Ejecta

20000031522 Laurentian Univ. of Sudbury, Ontario Canada
Origin of the Sudbury Igneous Complex and Sulfide Mineralization: Evidence from Platinum Group Elements
Xie, Q., Laurentian Univ. of Sudbury, Canada; Keays, R. R., Laurentian Univ. of Sudbury, Canada; Prevec, S. A., Laurentian Univ. of Sudbury, Canada; Lightfoot, P. C., Inco Ltd., Canada; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 65; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Despite intensive studies, some fundamental questions remain concerning the origin of the SIC and associated sulfide mineralization. Two questions are of primary importance: (1) Was the SIC formed by crustal melting resulting from a meteorite impact, or was it generated in an explosive intrusion of mantle-derived mafic magma? and (2) Where did all the metals (Ni, Cu, PGE, and S) come from? New geochemical data, including major and trace elements and PGE, have provided further constraints on these questions. Four drill cores that intersect the main mass felsic and mafic norite and the Sublayer were sampled. In all four drill cores, there is no simple trend of major and trace elements, nor of PGE, with increasing depth from felsic norite Through mafic norite to the Sublayer, as would be expected if the SIC represented a simple differentiated melt sheet. Rather, there is a major compositional gap between the main mass and the Sublayer. Chemically, the Sublayer is highly heterogeneous due to a highly variable inclusion content in both type and abundance. Compared with mantle-derived mafic and ultramafic magmas, the SIC is relatively depleted in PGE, with Ni/Pd (30,000-300,000) and Cu/Ir (60,000-7,000,000) ratios that closely resemble those of average continental crust. Sulfur/selenium ratios in the SIC range from 500 to 25,000, far exceeding those in mantle-derived magmas (3000-5000). Modeling of sulfide-silicate melt immiscible separation and fractional crystallization of monosulfide solid solution (mss) indicates that PGE data for the SIC may be best described by melting of continental crust with silicate/sulfide mass ratios (R factor) between 500 and 5000. The above evidence supports the hypothesis that the SIC was formed by crustal melting resulting from meteorite impact, and that metals (Ni, Cu, and PGE) came from preexisting crustal rocks, such as Early Proterozoic Nipissing diabase and East Bull Lake-type intrusions. Mass balance calculations for Ni, Cu, and PGE, the presence of ultramafic xenoliths in the Sublayer, and the orthopyroxene-rich nature of the felsic norite, however, suggest a contribution from a mantle-derived, high-MgO magma, possibly a picrite. While the addition of up to 20% picritic magma to the crustal melt sheet would not alter its composition significantly, it would provide the Ni, Cu, and PGE required to form the ore deposits as well as, by turbulent mixing with the crustal melt sheet, the mechanism by which sulfide saturation could be achieved. New PGE data further indicate that there is a large variation in ratios between PPGE (Pd-Pt-Rh) and IPGE (Ir-Os-Ru). In particular, Pd/Ir ratios vary from 2 to 600 in the Sublayer and Offset. Although the range of Pd/Ir ratios in the Sublayer and Offset may be largely explained by fractional crystallization of mss, and imperfect separation of mss and residual sulfide liquid, other processes, such as late-stage metasomatism, may have contributed to the large variation in PPGE/IPGE ratios.
Author
Geochemistry; Meteorite Collisions; Hypervelocity Impact; Meteoritic Damage; Impact Melts

20000031634 Aerospace Corp., Engineering and Technology Group, El Segundo, CA USA
Dawn/Dusk Dropouts due to Storms/Sub storms Near the Outer Radiation Belt: Observations from CRRES
Mouikis, C. G.; Korth, A.; Friedel, R. H.; Fennell, J. F.; Sep. 30, 1999; 9p; In English; Prepared in collaboration with Max-Planck-Inst fuer Aeronomie, Katlenburg-Lindau, Germany.
Contract(s)/Grant(s): F04701-93-C-0094
Report No.(s): AD-A372863; TR-99(8570)-5; SMC-TR-99-30; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We investigate the particle dropout events from the dawn flank of the magnetosphere as observed from a variety of instruments on board the CRRES satellite. All dropouts are observed at magnetic latitudes more than 100 above the magnetic equator. Plasma and energetic electron and ion data help us establish the boundary regimes being sampled. During these events, the magnetic field shows a dramatic change in the field line configuration from a dipole-like to a highly stretched tail-like. The LLBL moved to geosynchronous altitudes, and at times, the magnetospheric lobe is sampled. We conclude that they are associated with substorm growth phase stretching of the geomagnetic field during periods of intense storm activity.
DTIC
Magnetic Equator; Geomagnetism; CRRES (Satellite)

20000031702 Academia Sinica, Yunnan Observatory, Kunming, China
Analysis of the Relationship Between the Recent Major Earthquake in Yunnan and the Position of Celestial Objects
Li, Xiao-Ming, Academia Sinica, China; Hu, Hui, Academia Sinica, China; Publications of the Yunnan Observatory; 1996; ISSN 1001-7526, No. 4, pp. 75-80; In Chinese; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

After the three major earthquakes which happened in Menglian on July 12, 1995 with magnitude 7.3, in Wuding on October 24, 1995 with magnitude 6.5, and in Lijiang on February 3,1996 with magnitude 7.0 respectively we calculated the position of celestial objects in solar system when the earthquakes happened and the astronomical singularities in two days before the event and in two days after the event. Besides the eruption of the three events were on the fullmoon or new moon, the concentrated occurrence of astronomical singularities has their outstanding characteristics. There were 8 - 10 astronomical singularities in the five days for each event, and there were 5-6 the oppositions and conjunctions of the moon and planets. The zenith distances of the sun, moon and several planets were in the range 20 away from 90, therefore the vertical component of tide -generating acceleration were all direct to geocentre. The azimuth of the sun, moon and more than 4 planets were almost located at same plane, this is advantage for trigger of event.
Author
Celestial Bodies; Earthquakes; Geological Faults

20000031732 Air Force Research Lab., Space Vehicles Directorate, Hanscom AFB, MA USA
Direct Experimental Evidence for an Atmospheric Gravity Wave Cascade ***Interim Report***
Dewan, Edmond M.; May 27, 1999; 18p; In English
Contract(s)/Grant(s): Proj-2310
Report No.(s): AD-A372696; AFRL-VS-TR-1999-152; ERP-1219; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The saturated-cascade theory for atmospheric gravity wave (GW) spectra combines the physics of wave saturation with that of wave-wave interactions (the latter being in the form of a cascade). This theory successfully explained the slopes of 11 classes of measured GW spectra, the variability of some spectra compared to the quasi-universality of certain other spectra, and finally, the observed association between wavelength and wave period in individual wave observations. Unfortunately, the cascade properties in this theory have heretofore received only indirect confirmation in spite of the fact that direct evidence could be obtained by experimental means using today's technology. In this report, the available direct experimental evidence for the wave cascade that is now available in the papers by Nastrom et al. and Bacmeister et al. is examined, and further tests along these lines are suggested.
DTIC
Gravity Waves; Atmospheric Physics; Proving

20000031870 Instituto Geografico Nacional, Madrid, Spain
Magnetic Observations at the San Pablo (Toledo) and Guimar (Tenerife) Observatories, ***1996 Anuarios de Geomagnetismo: Observatorios de: San Pablo - Toledo (SPT) Guimar - Tenerife (GUI)***
1997; 126p; In Spanish; Original contains color illustrations; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This yearbook contains the results of the magnetic observations conducted in 1996 at th San Pablo-Toledo Observatory, located 50 kilometers southwest of the city of Toledo. In 1982, this observatory replaced the former Toledo Observatory (1934-1981). All the values included in this yearbook are referenced to the fundamental observation pillar whose coordinates are the following: (1) geographic coordinates: latitude 39 deg 32 min 50 sec N; longitude 4 deg 20 min 55 sec W; and elevation 922 m. (2) geomagnetic coordinates: latitude 43.1 deg N and longitude 75.9 deg E.
Author
Data Acquisition; Magnetic Measurement; Geomagnetic Latitude

47
METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification

20000029593 National Weather Service, Climate Prediction Center, Camp Springs, MD USA
Gridded Data Base of Daily Temperature Maxima and Minima for the Conterminous USA: 1948-1993
Janowiak, J. E.; Gell, G. D.; Chelliah, M.; Aug. 1999; 62p; In English
Report No.(s): PB2000-103168; NCEP/ATLAS-6; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

This atlas introduces a data base that contains gridded daily maximum and minimum temperature for the 48 conterminous USA for the period 1948-1993. The data set is variability in the USA and has been constructed from several thousand station reports throughout the USA dating back to at least 1948.
NTIS
Data Bases; Temperature Measurement

20000031600 NASA Goddard Inst. for Space Studies, New York, NY USA
ISCCP Cloud Properties Associated with Standard Cloud Types Identified in Individual Surface Observations
Hahn, Carole J., Arizona Univ., USA; Rossow, William B., NASA Goddard Inst. for Space Studies, USA; Warren, Stephen G., Washington Univ., USA; Nov. 29, 1999; 55p; Revised; In English
Contract(s)/Grant(s): NSF ATM-95-10170; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Individual surface weather observations from land stations and ships are compared with individual cloud retrievals of the International Satellite Cloud Climatology Project (ISCCP), Stage C1, for an 8-year period (1983-1991) to relate cloud optical thicknesses and cloud-top pressures obtained from satellite data to the standard cloud types reported in visual observations from the surface. Each surface report is matched to the corresponding ISCCP-C1 report for the time of observation for the 280x280-km grid-box containing that observation. Classes of the surface reports are identified in which a particular cloud type was reported present, either alone or in combination with other clouds. For each class, cloud amounts from both surface and C1 data, base heights from surface data, and the frequency-distributions of cloud-top pressure (p(sub c) and optical thickness (tau) from C1 data are averaged over 15-degree latitude zones, for land and ocean separately, for 3-month seasons. The frequency distribution of p(sub c) and tau is plotted for each of the surface-defined cloud types occurring both alone and with other clouds. The average cloud-top pressures within a grid-box do not always correspond well with values expected for a reported cloud type, particularly for the higher clouds Ci, Ac, and Cb. In many cases this is because the satellites also detect clouds within the grid-box that are outside the field of view of the surface observer. The highest average cloud tops are found for the most extensive cloud type, Ns, averaging 7 km globally and reaching 9 km in the ITCZ. Ns also has the greatest average retrieved optical thickness, tau approximately equal 20. Cumulonimbus clouds may actually attain far greater heights and depths, but do not fill the grid-box. The tau-p(sub c) distributions show features that distinguish the high, middle, and low clouds reported by the surface observers. However, the distribution patterns for the individual low cloud types (Cu, Sc, St) occurring alone overlap to such an extent that it is not possible to distinguish these cloud types from each other on the basis of tau-p(sub c) values alone. Other cloud types whose tau-p(sub c) distributions are indistinguishable are Cb, Ns, and thick As. However, the tau-p(sub c) distribution patterns for the different low cloud types are nevertheless distinguishable when all occurrences of a low cloud type are included, indicating that the different low types differ in their probabilities of co-occurrence with middle and high clouds.
Author
ISCCP Project; Satellite Observation; Climatology; Clouds (Meteorology); Cloud Physics; Weather; Weather Stations

20000031769 NASA Goddard Space Flight Center, Greenbelt, MD USA
Winter to Spring Transition in Europe 48-45 degrees N: From Temperature Control by Advection to Control by Insolation
Otterman, J., NASA Goddard Space Flight Center, USA; Ardizzone, J., General Sciences Corp., USA; Atlas, R., NASA Goddard Space Flight Center, USA; Hu, H., Harvard Univ., USA; Jusem, J. C., General Sciences Corp., USA; Starr, D., NASA Goddard Space Flight Center, USA; [1999]; 10p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

As established in previous studies, and analyzed further herein for the years 1988-1998, warm advection from the North Atlantic is the predominant control of the surface-air temperature in northern-latitude Europe in late winter. This thesis is supported by the substantial correlation Cti between the speed of the southwesterly surface winds over the eastern North Atlantic, as quantified by a specific Index Ina, and the 2-meter level temperature Ts over central Europe (48-54 deg N; 5-25 deg E), for January, February and early March. In mid-March and subsequently, the correlation Cti drops drastically (quite often it is negative). The change in the relationship between Ts and Ina marks a transition in the control of the surface-air temperature. As (a) the sun rises higher in the sky, (b) the snows melt (the surface absorptivity can increase by a factor of 3.0), (c) the ocean-surface

winds weaken, and (d) the temperature difference between land and ocean (which we analyze) becomes small, absorption of insolation replaces the warm advection as the dominant control of the continental temperature. We define the onset of spring by this transition, which evaluated for the period of our study occurs at pentad 16 (Julian Date 76, that is, March 16). The control by insolation means that the surface is cooler under cloudy conditions than under clear skies. This control produces a much smaller interannual variability of the surface temperature and of the lapse rate than prevailing in winter, when the control is by advection. Regional climatic data would be of greatest value for agriculture and forestry if compiled for well-defined seasons. For continental northern latitudes, analysis presented here of factors controlling the surface temperature appears an appropriate tool for this task. Author

Climatology; Central Europe; Temperature Control; Advection; Insolation; Winter; Spring (Season)

48
OCEANOGRAPHY

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

20000031775 Research Inst. of National Defence, Div. of Systems and Underwater Technology, Stockholm, Sweden

Transient Scattering from Submerged Objects. Theoretical Predictions and Experimental Results ***Transient Spridning fran Foeremal under Vatten och Inuti Sjoebotten: Teorestiska Prediktioner och Experimentella Resultat***

Karasalo, I.; Mattsson, J.; Jun. 1999; ISSN 1104-9154; 36p; In English; Portions of this document are not fully legible

Report No.(s): PB2000-103074; FOA-R-99-01169-409-SE; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Computational predictions of mono-and bistatic acoustic scattering by two different underwater objects are compared with results from a sea trial conducted in the Stockholm archipelago in September 1997 as part of the ISACS project for seafloor characterization and detection of buried underwater objects. The first object is a water-filled spherical steel shell lying on the seafloor, the second is a concrete-filled tractor tyre buried in the sediment. The objects are insonified by a vertically downward moving Ricker-like transient with center frequency 5 KHz, modeling the pulse emitted by a bottom-penetrating parametric sonar used in the trials. A frequency domain boundary-integral-equation method, developed recently as part of the ISACS project, is used. The method can handle scattering from smooth 3D bodies and shells in a layered fluid-solid medium. The scatterer may be either rigid, vacuous or a penetrable fluid volume enclosed in a thin elastic shell. Transient scattering is treated by Fourier synthesis with adaptive choice of the frequency grid. Parallel execution on a network of workstations under the MPICH message passing interface is used, to enable computationally demanding broad-band excitations of the presented type to be handled within manageable time.

NTIS

Acoustic Scattering; Submerged Bodies; Oceanography

51
LIFE SCIENCES (GENERAL)

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

20000028377 Institute of Space Medico-Engineering, Beijing, China

The Effects of Simulated Weightlessness on the Function of Spleen Lymphocytes and the Expression of C-Fos Proto-Oncogene in Tail-Suspended Mice

Zhang, Hong, Institute of Space Medico-Engineering, China; Hu, Ping, Institute of Space Medico-Engineering, China; Wen, Xiu-lan, Institute of Space Medico-Engineering, China; Huang, Bin, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; December 1999; ISSN 1002-0837; Volume 12, No. 6, pp. 423-424; In Chinese; Copyright Waived; Avail: Issuing Activity

To investigate the effect of simulated weightlessness on proliferation of spleen lymphocyte, production of interleukin-2 and expression of c-fos proto-oncogene in mice. Mice were tail-suspended for 7 or 14 days to simulate the effect of weightlessness; proliferation of lymphocyte was measured by MTT method, production of IL-2 was determined by biological activity and expression of c-fos proto-oncogene was determined by dot blotting. As compared with the control, the proliferation of spleen lymphocyte and the production of IL-2 were significantly decreased in 14 d suspended group, but the expression of c-fos

proto-oncogene was increased in both 7d and 14d suspended groups. This result suggested that simulated weightlessness could interfere with the genes regulating the lymphocyte.
Author
Immune Systems; Lymphocytes; Activity (Biology); Weightlessness; Spleen

20000029456 National Space Biomedical Research Inst., Houston, TX USA
National Space Biomedical Research Institute ***Annual Report, 1 Oct. 1998 - 30 Sep. 1999***
Sep. 30, 1999; 350p; In English; See also 20000029457 through 20000029496
Contract(s)/Grant(s): NCC9-58; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche

This report summarizes the activities of the National Space Biomedical Research Institute (NSBRI) during FY 1999, the second full year of existence of the NSBRI's research program, and is prepared in accordance with Cooperative Agreement NCC9-58 between NASA's Lyndon B. Johnson Space Center and Baylor College of Medicine (NSBRI). The report consists of progress reports on projects related to the effects of microgravity and space on physiology. The research is broken up in nine areas: (1) Bone loss, (2) Cardiovascular alterations, (3) human performance, (3) immunology, infection and hematology, (4) muscle alterations and atrophy,(5) Neurovestibular adaptation, radiation effects, (6) technology development, and (7) synergy projects.
CASI
Aerospace Medicine; University Program; Bioastronautics; Gravitational Physiology; Gravitational Effects; Physiological Effects; Physiological Responses

20000029459 Johns Hopkins Univ., School of Medicine, Baltimore, MD USA
The Effects of Partial Mechanical Loading and Ibandronate on Skeletal Tissues in the Adult Rat Hindquarter Suspension Model for Microgravity
Schultheis, Lester W., Johns Hopkins Univ., USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-10 - B-11; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We report initial data from a suspended rat model that quantitatively relates chronic partial weightbearing to bone loss. Chronic partial weightbearing is our simulation of the effect of limited artificial gravity aboard spacecraft or reduced planetary gravity. Preliminary analysis of bone by PQCT, histomorphometry, mechanical testing and biochemistry suggest that chronic exposure to half of Earth gravity is insufficient to prevent severe bone loss. The effect of episodic full weightbearing activity (Earth Gravity) on rats otherwise at 50% weightbearing was also explored. This has similarity to treatment by an Earth G-rated centrifuge on a spacecraft that normally maintained artificial gravity at half of Earth G. Our preliminary evidence, using the above techniques to analyze bone, indicate that 2 hours daily of full weightbearing was insufficient to prevent the bone loss observed in 50% weightbearing animals. The effectiveness of partial weightbearing and episodic full weightbearing as potential countermeasures to bone loss in spaceflight was compared with treatment by ibandronate. Ibandronate, a long-acting potent bisphosphonate proved more effective in preventing bone loss and associated functionality based upon structure than our first efforts at mechanical countermeasures. The effectiveness of ibandronate was notable by each of the testing methods we used to study bone from gross structure and strength to tissue and biochemistry. These results appear to be independent of generalized systemic stress imposed by the suspension paradigm. Preliminary evidence does not suggest that blood levels of vitamin D were affected by our countermeasures. Despite the modest theraputic benefit of mechanical countermeasures of partial weightbearing and episodic full weightbearing, we know that some appropriate mechanical signal maintains bone mass in Earth gravity. Moreover, the only mechanism that correctly assigns bone mass and strength to oppose regionally specific force applied to bone is mechanical, a process based upon bone strain. Substantial evidence indicates that the specifics of dynamic loading i.e. time-varying forces are critical. Bone strain history is a predictor of the effect that mechanical conditions have on bone structure mass and strength. Using servo-controlled force plates on suspended rats with implanted strain gauges we manipulated impact forces of ambulation in the frequency (Fourier) domain. Our results indicate that high frequency components of impact forces are particularly potent in producing bone strain independent of the magnitude of the peak force or peak energy applied to the leg. Because a servo-system responds to forces produced by the rat's own muscle activity during ambulation, the direction of ground-reaction loads act on bone through the rat's own musculature. This is in distinction to passive vibration of the floor where forces reach bone through the natural filters of soft tissue and joints. Passive vibration may also be effective, but it may or may not increase bone in the appropriate architectural pattern to oppose the forces of normal ambulatory activity. Effectiveness of high frequency mechanical stimulation in producing regional (muscle directed) bone response will be limited by 1. the sensitivity of bone to a particular range of frequencies and 2. the inertia of the muscles, limiting their response to external forces by increasing tension along insertions. We have begun mathematical modeling of normal ambulatory activity. Effectiveness of high frequency mechanical stimulation in producing regional (muscle directed) bone response will be limited by 1. the sensitivity of bone to a particular range of frequencies and 2. the inertia of the muscles, limiting their response to external forces by increasing tension along insertions. We

have begun mathematical modeling of the rat forelimb as a transfer function between impact force and bone strain to predict optimal dynamic loading conditions for this system. We plan additional studies of mechanical counter-measures that incorporate improved dynamic loading, features relevant to anticipated evaluation of artificial gravity, exercise regimens and exposure to Martian gravity, The combination of mechanical countermeasures with ibandronate will also be investigated for signs of synergy. Author

Bone Demineralization; Bones; Dynamic Loads; Mathematical Models; Microgravity; Musculoskeletal System; Physical Exercise; Bioastronautics

20000029464 Johns Hopkins Univ., School of Medicine, Baltimore, MD USA

Rodent Studies of Cardiovascular Deconditioning

Shoukas, Artin A., Johns Hopkins Univ., USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-24 - B-25; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Changes in blood pressure can occur for two reasons: 1) A decrease in cardiac output resulting from the altered contractility of the heart or through changes in venous filling pressure via the Frank Starling mechanism or; 2) A change in systemic vascular resistance. The observed changes in cardiac output and blood pressure after long term space flight cannot be entirely explained through changes in contractility or heart rate alone. Therefore, alterations in filling pressure mediated through changes in systemic venous capacitance and arterial resistance function may be important determinants of cardiac output and blood pressure after long term space flight. Our laboratory and previous studies have shown the importance of veno-constriction mediated by the carotid sinus baroreceptor reflex system on overall circulatory homeostasis and in the regulation of cardiac output. Our proposed experiments test the overall hypothesis that alterations in venous capacitance function and arterial resistance by the carotid sinus baroreceptor reflex system are an important determinant of the cardiac output and blood pressure response seen in astronauts after returning to earth from long term exposure to microgravity. This hypothesis is important to our overall understanding of circulatory adjustments made during long term space flight. It also provides a framework for investigating counter measures to reduce the incidence of orthostatic hypotension caused by an attenuation of cardiac output. We continue to use hind limb unweighted (HLU) rat model to simulate the patho physiological effects as they relate to cardiovascular deconditioning in microgravity. We have used this model to address the hypothesis that microgravity induced cardiovascular deconditioning results in impaired vascular responses and that these impaired vascular responses result from abnormal alpha-1 AR signaling. The impaired vascular reactivity results in attenuated blood pressure and cardiac output responses to an orthostatic challenge. We have used in vitro vascular reactivity assays to explore abnormalities in vascular responses in vessels from HLU animals and, cardiac output (CO), blood pressure (BP) and heart rate (HR) measurements to characterize changes in hemodynamics following HLU. Author

Blood Pressure; Cardiovascular System; Carotid Sinus Reflex; Heart; Heart Rate; Hemodynamic Responses; Microgravity; Physiological Effects; Physiological Responses; Bioastronautics

20000029496 Johns Hopkins Univ., Oncology Center, Baltimore, MD USA

Chemoprevention of Radiation Induced Rat Mammary Neoplasms

Huso, David L., Johns Hopkins Univ., USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-97 - B-98; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

Radiations encountered in space include protons and heavy ions such as iron as well as their secondaries. The relative biological effect (RBE) of these ions is not known, particularly at the doses and dose-rates expected for planetary missions. Neutrons, are not particularly relevant to space travel, but have been found experimentally to have an increase in their RBE with decreasing dose. If a similar trend of increasing RBE with decreasing dose is present for heavy ions and protons during irradiation in space, the small doses received during space travel could potentially have substantial carcinogenic risk. Clearly more investigation of the effects of heavy ions and protons is needed before accurate risk assessment for prolonged travel in space can be done. One means to mitigate the increased risk of cancer due to radiation exposure in space is by developing effective countermeasures that can reduce the incidence of tumor development. Tamoxifen has recently been shown to be an effective chemopreventive agent in both animal models and humans for the prevention of mammary tumors. Tamoxifen is a unique drug, with a highly specific mechanism of action affecting a specific radiation-sensitive population of epithelial cells in the mammary gland. In human studies, the annual incidence of a primary tumor in the contralateral breast of women with previous breast cancer is about 8 per 1000, making them an exceedingly high-risk group for the development of breast cancer. In this high risk group, treated with tamoxifen, daily, for 2 years, the incidence of a new primary tumor in the contralateral breast was approximately one third of that noted in the non-tamoxifen treatment group. Tamoxifen antagonizes the action of estrogen by competing for the nuclear receptor complex thereby altering the association of the receptor complex and nuclear binding sites. Its effects in reducing

the development of breast cancer could be accomplished by controlling clinically undetectable microcancers, arresting preneoplastic lesions, or correcting abnormal environments which predispose to high risk of malignant transformation.
Derived from text
Cancer; Carcinogens; Mammary Glands; Prevention; Radiation Effects; Relative Biological Effectiveness (RBE); Tumors; Neoplasms; Health Physics; Aerospace Medicine

20000029587 Chinese Academy of Medical Sciences, Beijing, China
Development and Prospect of Plant Mutation Breeding Induced by Aviation and Spaceflight in China
Li, Jin-gou, Chinese Academy of Medical Sciences, China; Wang, Pei-sheng, Chinese Academy of Medical Sciences, China; Zhang, Jian, Chinese Academy of Medical Sciences, China; Jiang, Xing-cun, Chinese Academy of Medical Sciences, China; Space Medicine and Medical Engineering; December 1999; ISSN 1002-0837; Volume 12, No. 6, pp. 464-468; In Chinese; Copyright; Avail: Issuing Activity

Since 1987, about fifty species and three hundred varieties of crops have been sent in recoverable satellites or high altitude balloon (HAB). The selected lines include a high-yield, disease-resistant, and hybrid-vigorous rice line, a recovered line of Japonica rice restoring sterility of Indica rice, a new green pepper strain which grows fruits over 500 g, a disease-resistant, high-quality tomato line, a big-pod rape line, a big-fruit white lotus line and a big-bulb lily. The special conditions in outer space can induce a variety of mutations in the plants and their progeny, which provides a new way for the plant breeding.
Author
Breeding (Reproduction); Farm Crops; Mutations; Space Flight; Mutagens; Plants (Botany); Botany

20000029599 National Bioethics Advisory Commission, Rockville, MD USA
Research Involving Human Biological Materials: Ethical Issues and Policy Guidance, Volume 1, Report and Recommendations of the National Bioethics Advisory Commission
Aug. 1999; 140p; In English
Report No.(s): PB2000-102936; No Copyright; Avail: CASI; A02, Microfiche; A07, Hardcopy

Contents include the following: Letter of Transmittal to the President; National Bioethics Advisory Commission; National Bioethics Advisory Commission Staff and Consultants; Executive Summary; Overview and Introduction; Collection, Storage, and Use of Human Biological Materials in the USA; Current Guidance on the Use of Human Biological Materials in Research; Ethical Perspectives on the Research Use of Human Biological Materials; Conclusions and Recommendations; Appendix A: Beliefs About the Research Use of Human Biological Materials; Appendix B: Code of Federal Regulations, Title 45, Part 46; Appendix C: Comparison Table of Professional Statements; Appendix D: Guidance for Institutional Review Boards Reviewing Research Using Human Biological Materials; Appendix E: Public Comments on NBAC's February 22, 1999 Draft; Appendix F: Public and Expert Testimony; and Appendix G: Commissioned Papers.
NTIS
Genetic Engineering; Research Management; Medical Science

20000029606 Institute of Space Medico-Engineering, Beijing, China
Immunoblotting Observation on Changes of Myosin Degradation Metabolism in Toad Gastrocnemius Muscle Electric Simulation Under Simulated Exercise Load
Ni, Cheng-zhi, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; December 1999; ISSN 1002-0837; Volume 12, No. 6, pp. 426-430; In Chinese; Copyright; Avail: Issuing Activity

The objective of this study was to probe into the optimum exercise load in sports training. Myosin heavy chain degradation fragments produced by different-intensity electric stimulation were identified in toad gastrocnemius muscle. The fragments were identified by electrophoresis of unfractionated extracts of toad gastrocnemius muscle on sodium dodecyl sulfate/polyacrylamide gels followed by immunoblotting on nitrocellulose sheets. Polyclonal antibody directed against the entire myosin were used to characterize the fragments. Toad gastrocnemius muscle protein degradation increased under high-intensity electric stimulation; two kinds of Myosin degradation fragments whose molecular weight were 43KD and 38KD respectively were produced by double high-intensity electric stimulation; the molecular weight 43KD immunoreactive myosin fragments produced by high-intensity electric stimulation disappeared under low-intensity electric stimulation. Continuous high-intensity exercise load would make muscle contractile protein further degrade while low-intensity exercise load would enhance the recover of contraction and function of the muscle.
Author
Cellulose Nitrate; Physical Exercise; Proteins; Stimulation; Metabolism

20000029607 Institute of Aviation Medicine, Beijing, China

Effects of Simulated Flight Hypobaric Hypoxia and Oxygen Inhalation on Free Radical Metabolism

Zhang, Qing-jun, Institute of Aviation Medicine, China; Zhan, Hao, Institute of Aviation Medicine, China; Li, Tong, Institute of Aviation Medicine, China; Hao, Ai-gong, Institute of Aviation Medicine, China; Wan, Chang-hong, Institute of Aviation Medicine, China; Xin, Yi-mei, Institute of Aviation Medicine, China; Space Medicine and Medical Engineering; December 1999; ISSN 1002-0837; Volume 12, No. 6, pp. 414-416; In Chinese; Copyright; Avail: Issuing Activity

The objective of this study was to investigate the effects of two types of simulated flight conditions (hypobaric hypoxia and hypobaric oxygen inhalation) on free radical metabolism in various organs of mice. Sixty male Kunming mice were randomly divided into six groups (n=10 each). The experiment was comprised of two parts. The first part included three groups: normal controls (Al), 1500 m hypobaric hypoxia for 4 wk (B1) and 8 wk (C1). The second part included another three groups: normal control (A2), 5500 m hypobaric oxygen inhalation for 4 wk (B2) and 8 wk(C2). The exposure time in hypobaric chamber was 2 h/d, 3 d/wk. After the experiment, caudal blood was taken for routine examination. The mice were decapitated on the next day and brain, heart, lung, liver and kidney homogenates were prepared for measuring malondialdehyde(MDA) content and superoxide dismutase (SOD) activity. Lipid peroxides in the lungs were significantly increased in Cl group, and the content of myocardial MDA and myocardial SOD activities in C2 group were markedly higher than those in A2 group. There were no significant differences among body weights, mean corpuscular indices and hemoglobin content in the normal control, hypobaric hypoxia and hypobaric oxygen inhalation groups. It demonstrates that repeated mild hypobaric hypoxia for 8 wk causes free radical damage in the lung and repeated exposure to 5500 m hypobaric oxygen inhalation for 8 wk may lead to myocardial peroxidative injury in mice. Simulated flight hypobaric hypoxia and oxygen inhalation may lead to free radicals damage of lung and myocardial peroxidative injury in mice.

Author

Damage; Hypobaric Atmospheres; Hypoxia; Lungs; Metabolism; Respiration

20000030739 NASA Lewis Research Center, Cleveland, OH USA

Method for Fabricating Soft Tissue Implants with Microscopic Surface Roughness

Banks, Bruce A., Inventor, NASA Lewis Research Center, USA; Rutledge, Sharon K., Inventor, NASA Lewis Research Center, USA; Oct. 12, 1999; 16p; In English

Patent Info.: Filed 22 Sep. 1997; NASA-Case-LEW-15805-1; US-Patent-5,965,076; US-Patent-Appl-SN-936492; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A method for fabricating soft tissue implants using a mold. The cavity surface of an initially untextured mold. made of an organic material such as epoxy. is given a thin film coating of material that has pinholes and is resistant to atomic particle bombardment. The mold cavity surface is then subjected to atomic particle bombardment, such as when placed in an isotropic atomic oxygen environment. Microscopic depressions in the mold cavity surface are created at the pinhole sites on the thin film coating. The thin film coating is removed and the mold is then used to cast the soft tissue implant. The thin film coating having pinholes may be created by chilling the mold below the dew point such that water vapor condenses upon it; distributing particles, that can partially dissolve and become attached to the mold cavity surface, onto the mold cavity surface; removing the layer of condensate, such as by evaporation; applying the thin film coating over the entire mold surface; and, finally removing the particles, such as by dissolving or brushing it off. Pinholes are created in the thin film coating at the sites previously occupied by the particles. Official Gazette of the U.S. Patent and Trademark Office

Fabrication; Procedures; Technology Assessment; Softness; Tissues (Biology); Implantation; Organic Materials; Surface Roughness; Thin Films

20000031601 NASA Ames Research Center, Moffett Field, CA USA

Membrane-Based Functions in the Origin of Cellular Life ***Final Report, 1 Oct. 1995 - 31 Mar. 1999***

Chipot, Christophe, Universite Henri-Poincare, France; New, Michael H., California Univ., USA; Schweighofer, Karl, NASA Ames Research Center, USA; Pohorille, Andrew, NASA Ames Research Center, USA; Wilson, Michael A., NASA Ames Research Center, USA; [1999]; 27p; In English

Contract(s)/Grant(s): NCC2-772; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Our objective is to help explain how the earliest ancestors of contemporary cells (protocells) performed their essential functions employing only the molecules available in the protobiological milieu. Our hypothesis is that vesicles, built of amphiphilic, membrane-forming materials, emerged early in protobiological evolution and served as precursors to protocells. We further assume that the cellular functions associated with contemporary membranes, such as capturing and transducing of energy, signaling, or sequestering organic molecules and ions, evolved in these membrane environments. An alternative hypothesis is that these functions evolved in different environments and were incorporated into membrane-bound structures at some later stage of

evolution. We focus on the application of the fundamental principles of physics and chemistry to determine how they apply to the formation of a primitive, functional cell. Rather than attempting to develop specific models for cellular functions and to identify the origin of the molecules which perform these functions, our goal is to define the structural and energetic conditions that any successful model must fulfill, therefore providing physico-chemical boundaries for these models. We do this by carrying out large-scale, molecular level computer simulations on systems of interest. Specific systems that we have investigated are: 1. Simulations of water-membrane systems to yield an accurate description of the electrical properties of the membranes. This was investigated by calculating the surface potentials of aqueous interfaces and the interaction of a number of small polar and nonpolar solute molecules with several membrane interfaces. 2. Simulations of ion transport across a water-membrane interface to investigate how ”thinning” defects in the membrane effectively increase the permeability of the membrane by several orders of magnitude over predictions based on simple, dielectric continuum models. Simulations of small peptides at the water-hexane interface to investigate how the interface affects the structure of the peptide, and in particular if short peptides, which are disordered in water, can fold into ordered structures at the interface.
Author
Biological Evolution; Cells (Biology); Computerized Simulation; Continuum Modeling; Membrane Structures; Protobiology

20000031618 NASA Langley Research Center, Hampton, VA USA
Method of and Apparatus for Histological Human Tissue Characterization Using Ultrasound
Yost, William T., Inventor, NASA Langley Research Center, USA; Cantrell, John H., Inventor, NASA Langley Research Center, USA; TalEr, George A., Inventor, NASA Langley Research Center, USA; Dec. 28, 1999; 10p; In English; Continuation of US-Patent-Appl-SN-592833, filed 26 Jan. 1996
Patent Info.: Filed 21 Apr. 1998; NASA-Case-LAR-15040-2; US-Patent-6,007,489; US-Patent-Appl-SN-071452; US-Patent-Appl-SN-592833; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A method and apparatus for determining important histological characteristics of tissue, including a determination of the tissue’s health. Electrical pulses are converted into meaningful numerical representations through the use of Fourier Transforms. These numerical representations are then used to determine important histological characteristics of tissue. This novel invention does not require rectification and thus provides for detailed information from the ultrasonic scan.
Author
Inventions; Patents; Histology; Tissues (Biology); Health

20000031641 Purdue Univ., Dept. of Earth and Atmospheric Sciences, West Lafayette, IN USA
Biosynthesis of 3-Dimethylsulfoniopropionate in Marine Algae ***Final Report, 1 Jan 1996-30 May 1999***
Rhodes, David; Feb. 04, 2000; 45p; In English
Contract(s)/Grant(s): N00014-96-1-0366
Report No.(s): AD-A373466; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

To participate in a 4-investigator collaboration (Hanson, Gage, Leustek, Rhodes) to elucidate the pathway of 3-dimethylsulfonipropionate (DMSP) in marine algae, including identification of intermediates and enzymes of the pathway in the macroalgae Enteromorpha Intestinalis, and three diverse marine phytoplankton species; Tetraselmis sp., Melosira Nummuloides, and Emiliania Huxleyi. Develop quantitative models describing flux of through the pathway and its competing branches, and investigate regulation of the pathway.
DTIC
Marine Biology; Algae; Phytoplankton; Biosynthesis

20000031652 Naval Postgraduate School, Monterey, CA USA
A Biologically Based Approach to the Mutation of Code
Vandenberg, Loretta L.; Sep. 1999; 165p; In English
Report No.(s): AD-A373187; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Evolutionary programming is a relatively new problem solving approach in the field of computer science. It attempts to model the processes of natural selection and evolution to solve complex problems. This technique is very powerful because it can be applied to a wide range of problems, and can find solutions that other more traditional techniques cannot. This research attempts to augment the methodology of an evolutionary programming approach with two new features: (1) dominant and recessive traits and (2) intron and exon regions. These features form the basis of a specialized approach for evolutionary programming which might be able to be applied to new problem areas where evolutionary programming usually performs poorly. This specialized approach is applied to the well known problem of a series expansion, so that the results are easily * compared to a known solution, and that the influence of these additional mechanisms on the population of solutions can be studied. Results from implementing

the new mechanisms individually and together are presented, and compared with a baseline evolutionary programming implementation.
DTIC
Computer Programming; Mutations; Populations; Series Expansion

20000031697 Fourth Military Medical Univ., Dept. of Aerospace Physiology, Xi'an, China
Effects of Simulated Weightlessness on Vasoreactivity of Hindlimb Arterial Bed in Rats
Ma, Jin, Fourth Military Medical Univ., China; Zhang, Le-ning, Fourth Military Medical Univ., China; Zhang, Li-fan, Fourth Military Medical Univ., China; Yang, Tian-de, Fourth Military Medical Univ., China; Space Medicine and Medical Engineering; August 1999; ISSN 1002-0837; Volume12, No. 4, pp. 254-257; In Chinese; Copyright; Avail: Issuing Activity

To investigate the alterations in vasoreactivity of hindlimb arterial bed after simulated weightlessness. The tail-suspended rat model was used to simulate weightlessness, and the alterations in vasoreactivity of arterial bed were examined in vitro using isolated, constant flow perfused hindlimb of 2-wk suspended rats and control rats. Perfusion flow-pressure relationship of hindlimb arterial bed showed no significant differences between suspended rats and control rats; but vascular responses to KCl(20 approx. 100 mM) and PE(10(exp -8) - 10(exp -4) M) were decreased in hindlimb arterial bed of suspended rats as compared with that of control rats. Contractile ability of resistance vessels was diminished in simulated weightlessness rats, and a compromised ability of resistance vessels to increase peripheral resistance may play an important role in occurrence of orthostatic intolerance.
Author
Cardiovascular System; Arteries; Weightlessness Simulation

20000031698 Fourth Military Medical Univ., Dept. of Aerospace Physiology, Xi'an, China
Ultrastructural Changes of Arterial Wall from Different Body Parts of Rats During Simulated Weightlessness
Mao, Qin-wen, Fourth Military Medical Univ., China; Zhang, Li-fan, Fourth Military Medical Univ., China; Zhang, Le-ning, Fourth Military Medical Univ., China; Ma, Jin, Fourth Military Medical Univ., China; Space Medicine and Medical Engineering; August 1999; ISSN 1002-0837; Volume 12, No. 4, pp. 249-253; In Chinese; Copyright; Avail: Issuing Activity

To test the nature of remodeling of arteries in different body parts in adapting to local hemodynamic changes induced by tail-suspension. Ultrastructural changes of hindlimb and cerebral arteries from 4-wk tail-guspended (SUS-4), 1-wk recovered, (REC-1), and control (CON) rats were studied by transmission electron microscopy. For the hindquarter arteries, like the femoral artery and anterior tibial artery, there were fewer smooth muscle layers , less myofilaments the smooth muscle cell (SMC), and more intercellular substance in SUS-4 group than in CON group. After 1-wk recovery, the internal elastic lamina of the arteries thickened, the amount of myofilaments in SMC increased, the content of intercellular substance restored, and neoformative SMCs emerged under the endothelium. With respect to arteries in the neck region and the brain, like the common carotid artery and basilar artery, SMCs of contractile phenotype were converted to that of synthetic phenotype, and migration and hyperplasia of SMCs also happened. After 1-wk recovery all these alterations weresomewhat restored. It provided further evidence that peripheral effector mechanism might play an important role in the genesis of postflight orthostatic intolerance.
Author
Arteries; Walls; Cerebrum; Hemodynamic Responses; Weightlessness Simulation

20000031699 Institute of Radiation Medicine, Beijing, China
Heavy Ion Radiation Induced Inactivation of Human Bronchial Epithelial Cells
Yuan, Xiong, Institute of Radiation Medicine, China; Ye, Chang-qing, Institute of Radiation Medicine, China; Yang, Mei-ying, Institute of Radiation Medicine, China; Liu, Lei-hua, Institute of Radiation Medicine, China; Lu, Xiu-qin, Institute of Radiation Medicine, China; Space Medicine and Medical Engineering; August 1999; ISSN 1002-0837; Volume 12, No. 4, pp. 240-244; In Chinese; Copyright; Avail: Issuing Activity

The objective is to observe the cell inactivating effects of Li, C and F ions. Li(Z = 3), C (Z = 6) and F(Z = 9) ion beams, with LETs of 100 keV/micron, 300 keV/micron and 1000 keV/micron, respectively were produced by HI-13 tandem accelerator at the Department of Nuclear Physics, China Institute of Atomic Energy. The human bronchial epithelium cell line(BEAS - 2B) was irradiated with the designed doses ranging from 0. 5 Gy to 6. 0 Gy. After irradiation, the cells were cultured at 1000/flask and the survival fractions were calculated. The cell survival fraction (SF non-unit) have negative exponential relations with dose (D, Gy) as shown by the fitted equations: SF = EXP(- D/1. 28) (Li); SF = EXP(- D/l. 19) (C); SF = EXP(- D/2. 09) (F), respectively. The sensitive parameters (Do, Gy) of radiation were Do = 1.28; Do = 1.18; Do = 2.09, respectively. The patterns of cell survival were fitted to single target model. The relative biological effectiveness (RBE) for Li, C and F ions were 2.54, 2.67, 1.55, respectively, compared with Do of gamma-ray irradiation. The inactivation cross sections for these ions were 12.5, 40.6 and 76.5

sq microns respectively. The effectiveness of radiation induced by heavy ions of Li, C and F was more serious than that of Co-60 gamma-ray, and more than one particle traversal are needed to kill a cell on the average.
Author
Heavy Ions; Irradiation; Bronchi; Cells (Biology); Epithelium; Relative Biological Effectiveness (RBE); Gamma Rays; Dosage

20000031750 Institute of Space Medico-Engineering, Beijing, China
A Feasibility Study on the Highly-Efficient Electronic Fluorescent Lamp Used as a Lighting Source for Cultivation of Higher Plant in Space
Guo, Shuang-sheng, Institute of Space Medico-Engineering, China; Xu, Bo, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; August 1999; ISSN 1002-0837; Volume 12, No. 4, pp. 293-297; In Chinese; Copyright; Avail: Issuing Activity

To testify that the Highly-efficient Electronic Fluorescent Lamp (HEFL) can be used as a sole lighting source for the cultivation of higher plants in space. The HEFL was utilized as the lighting source for the culture of three varieties of Luctuca sativa L in the lately-constructed Space Higher Plant Cultivation Ground-based Experimental Facility(SHPCGEF). Other culturing conditions were: temperature 20 +/-0.2 C, relative humidity (75 +/- 1)%, average photosynthetic active radiation (PAR) 70 micro mol/sq m s PPF, average wind velocity 0.45 m/s, photoperiod 24 h light/0 dark, peat + vermiculite substrate culture, useful growing area 1. 2 sq m, growing period 28 d, one variety was cultured at every batch. Following plant maturing and being harvested, observations of external morphology of above-ground parts of the plants, measurements and calculations of edible biomass output and photosynthetic efficiency, analysis of nutrient compositions such as proteins, fats, carbon-hydrates, amino acids, vitamins and elemental compositions of lettuce leaves, and comparisons with formerly-related experiments were made. All of the above-mentioned targets met our demands, some of them were superior to the results of other similar experiments. The HEFL can completely meet the needs for the growth and development of some higher plants planned to be grown in space, its physical characters basically accord with the demands, so it can be utilized as the only lighting source for higher plant growth in space environmental conditions.
Author
Feasibility Analysis; Fluorescence; Biomass; Controlled Atmospheres; Cultivation; Growth; Morphology; Vegetation Growth

20000031751 Institute of Space Medico-Engineering, Beijing, China
Protective Effect of RenShen Compound and DanHuang Compound on Muscle Atrophy in Suspended Rats
Ma, Yong-lie, Institute of Space Medico-Engineering, China; Sun, Ya-zhi, Institute of Space Medico-Engineering, China; Yang, Hong-hui, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; August 1999; ISSN 1002-0837; Volume 12, No. 4, pp. 281-283; In Chinese; Copyright; Avail: Issuing Activity

To study the protective effect of RenShen compound and DanHuang compound on muscle atrophy caused by simulated weightlessness in rats. Percentage and cross sectional area of fibers and ultrastructure of soleus(SOL) and gastrocnemius(GAS) were determined in 30 d tail suspended rats with or without administration of the medicine. The percentage of type I fiber of SOL in RenShen(RS) group and DanHuang(DH) group increased by (13.5 +/- 0.96) % (P less than 0.05) and (11.2 +/- 0.84) % (P less than 0.05) respectively, and those of GAS showed only an increasing trend as compared with suspension control(SC). Cross sectional area of muscle fibers of SOL and GAS in both groups increased, especially in RS group(P less than 0.05). The construction of SOL sarcomere in RS and DH groups was improved as compared with SC. RS and DH compounds can partially prevent muscle atrophy caused by tail suspension.
Author
Weightlessness Simulation; Rats; Muscles; Atrophy

20000031754 Institute of Space Medico-Engineering, Beijing, China
Changes of Blood Circulation, Muscle and Skeletal Systems in 30 d Tail-Suspented Rats
Shen, Xian-yun, Institute of Space Medico-Engineering, China; Cui, Wei, Institute of Space Medico-Engineering, China; Ma, Yong-lie, Institute of Space Medico-Engineering, China; Dong, Qi, Institute of Space Medico-Engineering, China; Wang, Tao, Institute of Space Medico-Engineering, China; Yang, Guang-hua, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; August 1999; ISSN 1002-0837; Volume 12, No. 4, pp. 277-280; In Chinese; Copyright; Avail: Issuing Activity

To confirm the tail-suspended rat model for the study of countermeasures against weightlessness. The changes of blood circulation, muscle and skeletal systems in control group rats (n = 15) and 30 d tail-suspended rats (n =15) were compared. Compared with the control group, the hemorrheology and erythrocyte deformability decreased significantly, muscle-fiber atrophy , muscle contraction function decreased, the type I muscle fibers transformed to the type II muscle fibers, bone-mineral content

of L3 and load capacity of femur declined, bone metabolism changed in the suspended rats. The tail-suspended rat is a suitable animal model for the study of countermeasures against weightlessness.
Author
Blood Circulation; Bone Mineral Content; Muscular Function; Musculoskeletal System; Rats; Weightlessness Simulation

20000031755 Air Force Medical Coll., Jilin, China
Changes of Serum Biochemical Parameters During Hypothermia and Hypoxia in Rats
Mei, Dan, Air Force Medical Coll., China; Xu, Bin, Air Force Medical Coll., China; Sun, Kui, Air Force Medical Coll., China; Wang, Li-hua, Air Force Medical Coll., China; Zhang, Wei, Air Force Medical Coll., China; Space Medicine and Medical Engineering; August 1999; ISSN 1002-0837; Volume 12, No. 4, pp. 274-276; In Chinese; Copyright; Avail: Issuing Activity

To study the effects of hypothermia and hypoxia on serum biochemical parameters. Acute hypobaric hypoxia experiment in cold environment was carried out in 48 healthy Wistar rats to observe changes of hepatic, cardiac and renal functions. Hepatic, cardiac and renal functions changed non-prominently after acute hypoxia exposure under cold condition. Under hypoxic exposure of the same degree, serum lactic dehydrogenase (LDH), alanine transaminase (ALT), blood urea nitrogen (BUN) and creatinine(Cr) increased more significantly at 10 C than those at 20 C (P less than 0.01) while creatine kinase (CK) decreased significantly at 10 C than that at 20 C. After acute hypoxia in cold environment, the changes in cardiac function did not simplely equal to the changes by cold environment plus changes by acute hypoxia.
Author
Serums; Biochemistry; Hypothermia; Hypoxia; Rats

20000031756 Academy of Military Medical Sciences, Inst. of Hygiene and Environmental Medicine, Beijing, China
Effects of Acute Hypoxia and Hypoxic Acclimatization on Cardiac Functions of Rats
Long, Chao-liang, Academy of Military Medical Sciences, China; Yin, Zhao-yun, Academy of Military Medical Sciences, China; Sun, Xing-bin, Academy of Military Medical Sciences, China; Zhou, Zhi, Academy of Military Medical Sciences, China; Lu, Xing-qiang, Academy of Military Medical Sciences, China; Wang, Hai, Academy of Military Medical Sciences, China; Space Medicine and Medical Engineering; August 1999; issn 1002-0837; Volume 12, No. 4, pp. 267-269; In Chinese; Copyright; Avail: Issuing Activity

To study the effects of acute hypoxia and intermittent hypoxic acclimatization on cardiac systolic and diastolic functions in rats. Cardiac functions were investigated after intermittent hypoxic acclimatizated (3000 m and 5000 in, 2 wk respectively, 4 h/d) and normoxic rats were exposed to hypoxia (8000 m) for 4 h. The systolic functional parameters such as LVSP, + dP/dt(sub max), V(sub pm), V(sub max) and the diastolic functional parameter - dp/dt(sub max) of acute hypoxic rats were reduced significantly as compared with normoxic control rats. After hypoxic acclimatization, the left ventricular functions of rats were increased significantly as compared with those of acute hypoxic rats. But they were still lower than those of normoxic control rats. Acute hypoxia can affect cardiac functions and hypoxic acclimatization can alleviate the hypoxic effects on cardiac functions.
Author
Hypoxia; Acclimatization; Heart Function; Rats

20000031926 Academia Sinica, Inst. of Genetics, Beijing, China
Studies on Hereditary Variations of Millet Seed after High Altitude Balloon Flight
Li, Jin-Guo, Academia Sinica, China; Jiang, Guo-Yong, Academia Sinica, China; Wang, Pei-Sheng, Academia Sinica, China; Zhang, Jian, Academia Sinica, China; Jiang, Xing-Cun, Academia Sinica, China; Space Medicine and Medical Engineering; Oct. 1999; ISSN 1002-0837; Volume 12, No. 5, pp. 346-350; In Chinese
Report No.(s): CN-11-2774/R; Copyright; Avail: Issuing Activity

The objective is to select high yield, high protein and fatty acid millet. Air-dried seeds of millet were carried by high altitude balloon (HAB) for 8 h. Botany characteristics of these seeds were analyzed and studied after recovery. Germinating potential rose 21.1%, germinating percentage reduced 5.2% as compared with the control; plant height was 6.8 cm lower than that of the control in SPI ; while flag-leaf area and spike weight were 25% and 15.9% higher than those of the control respectively. Large-spike strains were stable in SP3 progeny. In SP3(-2), the contents of seed protein and fatty acid were more than those of control; in SP3(-5), the average spike length was 5.8 cm, and the content of Fe element in seed was 61.5 mg/kg more than these of control; in SP4 superspike strains, spike character, chlorophyll content and photosynthetic rate were significantly higher than the control during growing phase and growing anaphase, photosynthetic rate in flag-leaf was over 27.9% higher than those in the control. New strains

with high protein and fatty acid and high yield could be selected by HAB. The characteristics of these variations in the new strain is hereditable.
Author
Millet; Seeds; Heredity; Variations

20000031935 Air Force General Hospital, Molecular Biology Research Center, Beijing, China
Expression of HSP70 Gene in Rat Brain after Exposures to Repeated +Gz
Cai, Qing, Air Force General Hospital, China; Liu, Hong-Jin, Air Force General Hospital, China; Chen, You-Chun, Air Force General Hospital, China; Ji, Gui-Ying, Air Force General Hospital, China; Chen, Tong-Xin, Air Force General Hospital, China; Space Medicine and Medical Engineering; Oct. 1999; ISSN 1002-0837; Volume 12, No. 5, pp. 313-317; In English
Report No.(s): CN-11-2774/R; Copyright; Avail: Issuing Activity

The objective is to study the changes of mRNA expression of heat shock protein 70 (HSP70) in the rat brain exposed to repeated +Gz. The mRNA expression levels of HSP70 in rat brain were measured by semi-quantitative reverse transcription polymerase chain reaction (RT - PCR). The HSP70 mRNA expression levels in rat brains taken 30 min and 6 h after repeated +Gz exposures were significantly higher than those in control group, while the difference between the levels of control group and those of experimental rat brains taken 24 h after +Gz exposure was not significant. It is suggested that HSP70 mRNA expression in rat brain can be induced by repeated +Gz exposures and the increased HSP70 mRNA expression may play an important role in self-protection against brain damage induced by +Gz exposures.
Author
Brain Damage; Exposure; Gene Expression; Thermal Shock; Proteins

20000031966 Academia Sinica, Inst. of Genetics, Beijing, China
A Study on the Ultrastructure of Plant Cell Under Simulated Microgravity
Liu, Min, Academia Sinica, China; Wang, Ya-Lin, Academia Sinica, China; Xue, Huai, Academia Sinica, China; Zhang, Chun-Hua, Academia Sinica, China; Li, She-Rong, Academia Sinica, China; Space Medicine and Medical Engineering; Oct. 1999; ISSN 1002-0837; Volume 12, No. 5, pp. 360-363; In Chinese
Report No.(s): CN-11-2774/R; Copyright; Avail: Issuing Activity

The objective is to study the effects of microgravity on plant cell ultrastructure. Analyzing the biological and physiological differences between the plants grown in the simulated microgravity conditions and their correspondent ground controls. Various variances in cell walls, chloroplasts and mitochondria were observed with electron microscope. Those ultrastructure changes included plasmolysis, twist, contraction and deformation of cell walls, curvature and loose arrangement of chloroplast lamellae, breach of mitochondria, overflow of inclusions, disappearance of cristae, and significant increase in number of starch grains per cell. Simulated microgravity conditions exert some coerce influence on the plant growth and the changes above-mentioned were the responses in cell level.
Author
Cells (Biology); Plants (Botany); Microgravity

20000031975 Institute of Space Medico-Engineering, Beijing, China
Effects of Low Concentration Carbon Monoxide on the Neurobehavior Function in Mice
Liang, Hong, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Oct. 1999; ISSN 1002-0837; Volume 12, No. 5, pp. 318-322; In Chinese
Report No.(s): CN-11-2774/R; Copyright; Avail: Issuing Activity

The objective is to study the effect of low concentration CO on neurobehavior function and the maximal allowable concentration (MAC) in limited time. 40 KM (kunming) male mice were randomly divided into groups A, B, C and D. They were exposed to normal air, 30 mg/m(exp 3) CO, 300 mg/m(exp 3) CO and 600 mg/m(exp 3) CO respectively. The changes in neurobehavior function of the mice before, during and after 72 h exposure in 0.5 m(exp 3) static chambers were observed. Four indices were measured: response time (RT) and error rate (ER) in the water maze test, enter check frequency (ECF) and urine or excrement frequency (UEF) in open field test. The set upright frequency in group D was smaller than those in groups A, B and C during exposure. RT and ER values went in a direction contrary to pre-exposure the four groups in the second 3 days (6 d) after or out of exposure, while ER values showed that group D is greater than group C is greater than group A is greater than group B in the third 3 days (9 d) . RT value was not different among the 4 groups, but its order of numerical value was similar to the ER order. The order of ECF values was that group C is greater than group A and group D in 3 d after or out of exposure and not different among the 4 groups in 6 d and group D is less than group A and group B in 9 d. UEF values were not different among the 4 groups in 3 d and 9 d, but group group A and group B in 6 d after or out of exposure. Comparison with every group itself, showed

statistically significance increase in ER values in 9 d out of exposure than' before exposure in group D. ECF values showed the statistics significant increase in 9 d in group A and B. Low concentration CO may interfere with the learning and memory of mice in the water maze and impede the development of the motor nervous function and disturb the steadiness of emotion of mice in the open field. In addition, low concentration of CO may be of tardy toxicity.
Author
Carbon Monoxide; Low Concentrations; Behavior

20000031976 Institute of Space Medico-Engineering, Beijing, China
Effects of 7 d Head-Down Tilt(-20 deg) Immobilization on Pharmacokinetics of Gentamicin in Rabbits
Guo, Zhi-Feng, Institute of Space Medico-Engineering, China; Gao, Jian-Yi, Institute of Space Medico-Engineering, China; Wang, Bao-Zhen, Institute of Space Medico-Engineering, China; Shi, Hong-Zhi, Institute of Space Medico-Engineering, China; Wang, Jing, Institute of Space Medico-Engineering, China; Qian, Jin-Kang, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Oct. 1999; ISSN 1002-0837; Volume 12, No. 5, pp. 333-337; In Chinese
Report No.(s): CN-11-2774/R; No Copyright; Avail: Issuing Activity

The objective is to observe pharmacokinetic changes under simulated weightlessness in relevant to body flood flow changes. Gentamicin was selected as probe drug in the present study, and rabbits exposed to Head-Down Tilt (HDT, -20 deg) immobilization were selected as simulated weightlessness animal model. Seven rabbits were treated inf. with 3 mg/kg of gentamicin sulfate pre-HDT and 7 d after HDT. Gentamicin blood samples within 4 h after administration were analyzed by TDxFLx. The distribution of gentamicin postponed significantly: a significant decrease in a from (0.1838 +/- 0.1076) min(exp -1) before HDT to (0.0591 +/- 0.0334) min(exp -1) after HDT; a significant increase in t(l/2) alpha from (5.30 +/- 3.55) min to (15.04 +/- 7.49) min; a significant decrease in k(l2) from (0.1025 +/- 0.0721) min(exp -1) to (0.0181 +/- 0.0161 min(exp -1), a increase trend in V(C) and V(D), After HDT, CL(s) of gentamicin increased from (2.2 +/- 0.5) ml. min(exp -1).kg(exp -1) to (2.7 +/- 0.3)ml.min(exp -1).kg(exp -1). Simulated weightlessness might induce pharmacokinetic changes.
Author
Physiological Responses; Head Down Tilt; Immobilization; Pharmacology; Hypokinesia

20000031978 Chinese Academy of Medical Sciences, Inst. of Medicinal Plant Development, Beijing, China
Effects of Gastrodia on Rotation Induced Motion Sickness in Mice
Wang-Sheng-Ping, Chinese Academy of Medical Sciences, China; Liu, Xin-Min, Chinese Academy of Medical Sciences, China; Shang, Wei-Fen, Chinese Academy of Medical Sciences, China; Song, Jie, Chinese Academy of Medical Sciences, China; Yu, Shu-Ren, Chinese Academy of Medical Sciences, China; Sun, Shao-Mei, Chinese Academy of Medical Sciences, China; Space Medicine and Medical Engineering; Oct. 1999; ISSN 1002-0837; Volume 12, No. 5, pp. 342-345; In Chinese
Report No.(s): CN-11-2774/R; Copyright; Avail: Issuing Activity

The objective is to observe the effect of Gastrodia on motion sickness induced by rotation in mice. Clockwise and anticlockwise accelerated rotations up to 180 deg/s for 10 min were used to induce symptoms of motion sickness such as condition taste aversion (CTA), decrease of spontaneous locomotion and impaired ability of space identification in water-maze. Gastrodia could improve the response of CTA, increase spontaneous locomotion, and enhance the ability of learning and memory in water-maze in mice after the rotation. Symptoms of motion sickness induced by rotation could be improved by Gastrodia treatment.
Author
Rotation; Motion Sickness

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.

20000029457 Baylor Coll. of Medicine, Houston, TX USA
Novel Receptor-Based Countermeasures to Microgravity-Induced Bone Loss
OMalley, Bert W., Baylor Coll. of Medicine, USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-7; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The biological actions mediated by the estrogen receptor (ER), vitamin D receptor (VDR) and Ca(sup 2+) (sub o) -sensing receptor (CaR) play key roles in the normal control of bone growth and skeletal turnover that is necessary for skeletal health. These receptors act by controlling the differentiation and/or function of osteoblasts and osteoclasts, and other cell types within the bone and bone marrow microenvironment. The appropriate use of selective ER modulators (SERMS) which target bone, vitamin D analogs that favor bone formation relative to resorption, and CaR agonists may both stimulate osteoblastogenesis and inhibit osteoclastogenesis and the function of mature osteoclasts, should make it possible to prevent the reduction in bone formation and increase in bone resorption that normally contribute to the bone loss induced by weightlessness. Indeed, there may be synergistic interactions among these receptors that enhance the actions of any one used alone. Therefore, we proposed to: 1) assess the in vitro ability of novel ER, VDR and CaR agonists, alone or in combination, to modulate osteoblastogenesis and mature osteoblast function under conditions of 1g and simulated microgravity; 2) assess the in vitro ability of novel ER, VDR and CaR agonists, alone or in combination, to modulate osteoclastogenesis and bone resorption under conditions of lg and simulated microgravity; and 3) carry out baseline studies on the skeletal localization of the CaR in normal rat bone as well as the in vivo actions of our novel ER- and VDR-based therapeutics in the rat in preparation for their use, alone or in combination, in well-established ground-based models of microgravity and eventually in space flight.
Author
Bone Demineralization; Bones; Microgravity; Biological Effects; Weightlessness; Osteoporosis; Physiological Effects

20000029458 Texas A&M Univ., College Station, TX USA
Bone Blood Flow During Simulated Microgravity: Physiological and Molecular Mechanisms
Bloomfield, Susan A., Texas A&M Univ., USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-8 - B-9; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Blood flow to bone has been shown to affect bone mass and presumably bone strength. Preliminary data indicate that blood flow to the rat femur decreases after 14 days of simulated microgravity, using hindlimb suspension (HLS). If adult rats subjected to HLS are given dobutamine, a synthetic catecholamine which can cause peripheral vasodilation and increased blood flow, the loss of cortical bone area usually observed is prevented. Further, mechanisms exist at the molecular level to link changes in bone blood flow to changes in bone cell activity, particularly for vasoactive agents like nitric oxide (NO). The decreases in fluid shear stress created by fluid flow associated with the shifts of plasma volume during microgravity may result in alterations in expression of vasoactive agents such as NO, producing important functional effects on bone cells. The primary aim of this project is to characterize changes in 1) bone blood flow, 2) indices of bone mass, geometry, and strength, and 3) changes in gene expression for modulators of nitric oxide activity (e.g., nitric oxide synthase) and other candidate genes involved in signal transduction of mechanical loading after 3, 7, 14, 21, and 28 days of HLS in the adult rat. Using a rat of at least 5 months of age avoids inadvertently studying effects of simulated microgravity on growing, rather than adult, bone. Utilizing the results of these studies, we will then define how altered blood flow contributes to changes in bone with simulated microgravity by administering a vasodilatory agent (which increases blood flow to tissues) during hindlimb suspension. In all studies, responses in the unloaded hindlimb bones (tibial shaft, femoral neck) will be compared with those in the weightbearing humeral shaft and the non-weightbearing calvarium (skull) from the same animal. Bone volumetric mineral density and geometry will be quantified by peripheral quantitative CT; structural and material properties of the long bones will be determined by 3-point bending (tibia, humerus) or compression (femoral neck) testing to failure. A unique aspect of these studies will be defining the time course of changes in gene expression in bone cell populations with unloading, accomplished with Northern blots, in situ hybridization, and immunohistochemistry. These studies have high relevance for concurrent protocols being proposed by investigators on NSBRI Cardiovascular and Muscle teams, with blood flow data available on a number of tissues other than bone. Further, dobutamine and other Beta-agonists have been tested as countermeasures for altered muscle and cardiovascular function. Results of the intervention tested in our studies have potential relevance for a number of systemic changes seen with prolonged spaceflight.
Author
Blood Flow; Bones; Microgravity; Weightlessness; Bone Demineralization

20000029460 Johns Hopkins Univ., Baltimore, MD USA
Skeletal Structural Consequences of Reduced Gravity Environments
Ruff, Christropher B., Johns Hopkins Univ., USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-12 - B-14; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The overall goal of this project is to provide structurally meaningful data on bone loss after exposure to reduced gravity environments so that more precise estimates of fracture risk and the effectiveness of countermeasures in reducing fracture risk can be developed. The project has three major components: (1) measure structural changes in the limb bones of rats subjected to complete and partial nonweightbearing, with and without treatment with ibandronate and periodic full weightbearing; (2) measure

structural changes in the limb bones of human bedrest subjects, with and without treatment with alendronate and resistive exercise, and Russian cosmonauts flying on the Mir Space Station; and (3) validate and extend the 2-dimensional structural analyses currently possible in the second project component (bedrest and Mir subjects) using 3-dimensional finite element modeling techniques, and determine actual fracture-producing loads on earth and in space.
Author
Bone Demineralization; Finite Element Method; Microgravity; Musculoskeletal System; Bioastronautics

20000029461 Brigham and Women's Hospital, Boston, MA USA
Cardiovascular Deconditioning in Humans: Human Studies Core
Williams, Gordon, Brigham and Women's Hospital, USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-18 - B-19; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Major cardiovascular problems, secondary to cardiovascular deconditioning, may occur on extended space missions. While it is generally assumed that the microgravity state is the primary cause of cardiovascular deconditioning, sleep deprivation and disruption of diurnal rhythms may also play an important role. Factors that could be modified by either or both of these perturbations include: autonomic function and short-term cardiovascular reflexes, vasoreactivity, circadian rhythm of cardiovascular hormones (specifically the renin-angiotensin system) and renal sodium handling and hormonal influences on that process, venous compliance, cardiac mass, and cardiac conduction processes. The purpose of the Human Studies Core is to provide the infrastructure to conduct human experiments which will allow for the assessment of the likely role of such factors in the space travel associated cardiovascular deconditioning process and to develop appropriate countermeasures. The Core takes advantage of a newly-created Intensive Physiologic Monitoring (IPM) Unit at the Brigham and Women's Hospital, Boston, MA, to perform these studies. The Core includes two general experimental protocols. The first protocol involves a head down tilt bed-rest study to simulate microgravity. The second protocol includes the addition of a disruption of circadian rhythms to the simulated microgravity environment. Before and after each of these environmental manipulations, the subjects will undergo acute stressors simulating changes in volume and/or stress, which could occur in space and on return to Earth. The subjects are maintained in a rigidly controlled environment with fixed light/dark cycles, activity pattern, and dietary intake of nutrients, fluids, ions and calories.
Author
Cardiovascular System; Circadian Rhythms; Heart; Microgravity; Sleep Deprivation; Physiological Tests; Bioastronautics

20000029462 Massachusetts Inst. of Tech., Cambridge, MA USA
Cardiovascular Deconditioning in Humans: Alteration in Cardiovascular Regulation and Function During Simulated Microgravity
Cohen, Richard, Massachusetts Inst. of Tech., USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-20 - B-21; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Alterations in cardiovascular regulation and function that occur during and after space flight have been reported. These alterations are manifested, for example, by reduced orthostatic tolerance upon reentry to the earth's gravity from space. However, the precise physiologic mechanisms responsible for these alterations remain to be fully elucidated. Perhaps, as a result, effective countermeasures have yet to be developed. In this project we apply a powerful, new method - cardiovascular system identification (CSI) - for the study of the effects of space flight on the cardiovascular system so that effective countermeasures can be developed. CSI involves the mathematical analysis of second-to-second fluctuations in non-invasively measured heart rate, arterial blood pressure (ABP), and instantaneous lung volume (ILV - respiratory activity) in order to characterize quantitatively the physiologic mechanisms responsible for the couplings between these signals. Through the characterization of all the physiologic mechanisms coupling these signals, CSI provides a model of the closed-loop cardiovascular regulatory state in an individual subject. The model includes quantitative descriptions of the heart rate baroreflex, autonomic function, as well as other important physiologic mechanisms. We are in the process of incorporating beat-to-beat fluctuations of stroke volume into the CSI technique in order to quantify additional physiologic mechanisms such as those involved in control of peripheral vascular resistance and alterations in cardiac contractility. We apply CSI in conjunction with the two general protocols of the Human Studies Core project. The first protocol involves ground-based, human head down tilt bed rest to simulate microgravity and acute stressors - upright tilt, standing and bicycle exercise - to provide orthostatic and exercise challenges. The second protocol is intended to be the same as the first but with the addition of sleep deprivation to determine whether this contributes to cardiovascular alterations. In these studies, we focus on the basic physiologic mechanisms responsible for the alterations in cardiovascular regulation and function during the simulated microgravity in order to formulate hypotheses regarding what countermeasures are likely to be most effective. Compared to our original proposal, the protocol we are using has been slightly modified to lengthen the bed rest period to 16 days and streamline the data collection. These modifications provide us data on a longer bed rest period and have enabled us to increase

our subject throughput. Based on review of our preliminary data we have decided to test a countermeasure which is applied the very end of the bed rest period. We will use the same bed rest protocol to test this countermeasure. We anticipate completing the baseline data collection in our first protocol plus testing of the countermeasure in an additional eight subjects, at which time we plan to initiate the second protocol which includes sleep deprivation. In future studies, we plan to apply CSI to test other potential countermeasures in conjunction with the same bed rest, sleep deprivation and acute stressor models. We also anticipate applying CSI for studying astronauts before and after space flight and ultimately, during space flight. The application of CSI is providing information relevant to the development and evaluation of effective countermeasures allowing humans to adapt appropriately upon re-exposure to a gravity field, and to live and work for longer periods of time in microgravity.
Author
Cardiovascular System; Countermeasures; Heart; Microgravity; Physical Exercise; Physiology; Sleep Deprivation; Bioastronautics

20000029463 Brigham and Women's Hospital, Boston, MA USA
Renal and Cardio-Endocrine Responses in Humans to Simulated Microgravity
Williams, Gordon H., Brigham and Women's Hospital, USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-22 - B-23; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The volume regulating systems are integrated to produce an appropriate response to both acute and chronic volume changes. Their responses include changing the levels of the hormones and neural inputs of the involved systems and/or changing the responsiveness of their target tissues. Weightlessness during space travel produces a volume challenge that is unfamiliar to the organism. Thus, it is likely that these volume regulatory mechanisms may respond inappropriately, e.g., a decrease in total body volume in space and abnormal responses to upright posture and stress on return to Earth. A similar "inappropriateness" also can occur in disease states, e.g., congestive heart failure. While it is clear that weightlessness produces profound changes in sodium and volume homeostasis, the mechanisms responsible for these changes are incompletely understood. Confounding this analysis is sleep deprivation, common in space travel, which can also modify volume homeostatic mechanisms. The purpose of this project is to provide the required understanding and then to design appropriate countermeasures to reduce or eliminate the adverse effects of microgravity. to accomplish this we are addressing five Specific Aims: (1) To test the hypothesis that microgravity modifies the acute responsiveness of the renin-angiotensin-aldosterone system (RAAS) and renal blood flow; (2) Does simulated microgravity change the circadian rhythm of the volume- regulating hormones?; (3) Does simulated microgravity change the target tissue responsiveness to angiotensin 11 (AngII)?; (4) Does chronic sleep deprivation modify the circadian rhythm of the RAAS and change the acute responsiveness of this system to posture beyond what a microgravity environment alone does? and (5) What effect does salt restriction have on the volume homeostatic and neurohumoral responses to a microgravity environment? Because the RAAS plays a pivotal role in blood pressure control and volume homeostasis, it likely is a major mediator of the adaptive cardio-renal responses observed during space missions and is a special focus of this project. Thus, the overall goal of this project is to assess the impact of microgravity and sleep deprivation in humans on volume-regulating systems. to achieve this overall objective, we are evaluating renal blood flow and the status and responsiveness of the volume- regulating systems (RAAS, atrial natriuretic peptide and vasopressin), and the adrenergic system (plasma and urine catecholamines) in both simulated microgravity and normal gravity with and -Without sleep deprivation. Furthermore, the responses of the volume homeostatic mechanisms to acute stimulation by upright tilt testing, standing and exercise are being evaluated before and after achieving equilibrium with these interventions.
Author
Microgravity; Renal Function; Endocrine Systems; Kidneys; Cardiovascular System; Blood Volume; Bioastronautics; Physiological Responses

20000029465 Massachusetts Inst. of Tech., Cambridge, MA USA
Computational Models of the Cardiovascular System and Its Response to Microgravity
Kamm, Roger D., Massachusetts Inst. of Tech., USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-26; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Computational models of the cardiovascular system are powerful adjuncts to ground-based and in-flight experiments. We will provide NSBRI with a model capable of simulating the short-term effects of gravity on cardiovascular function. The model from this project will: (1) provide a rational framework which quantitatively defines interactions among complex cardiovascular parameters and which supports the critical interpretation of experimental results and testing of hypotheses. (2) permit predictions of the impact of specific countermeasures in the context of various hypothetical cardiovascular abnormalities induced by microgravity. Major progress has been made during the first 18 months of the program: (1) We have developed an operational first-order computer model capable of simulating the cardiovascular response to orthostatic stress. The model consists of a lumped

parameter hemodynamic model and a complete reflex control system. The latter includes cardiopulmonary and carotid sinus reflex limbs and interactions between the two. (2) We have modeled the physiologic stress of tilt table experiments and lower body negative pressure procedures (LBNP). We have verified our model's predictions by comparing them with experimental findings from the literature. (3) We have established collaborative efforts with leading investigators interested in experimental studies of orthostatic intolerance, cardiovascular control, and physiologic responses to space flight. (4) We have established a standardized method of transferring data to our laboratory from the ongoing NSBRI bedrest studies. We use this data to estimate input parameters to our model and compare our model predictions to actual data to further verify our model. (5) We are in the process of systematically simulating current hypotheses concerning the mechanism underlying orthostatic intolerance by matching our simulations to stand test data from astronauts pre- and post-flight. (6) We are in the process of developing a JAVA version of the simulator which will be distributed amongst the cardiovascular team members. Future work on this project involves modifications of the model to represent a rodent (rat) model, further evaluation of the bedrest astronaut and animal data, and systematic investigation of specific countermeasures.

Author

Cardiovascular System; Computerized Simulation; Gravitational Effects; Heart Function; Hemodynamic Responses; Lower Body Negative Pressure; Mathematical Models; Microgravity; Orthostatic Tolerance; Physiological Responses; Simulation; Bioastronautics

20000029466 Massachusetts Inst. of Tech., Cambridge, MA USA

Non-Invasive Assessment of Susceptibility to Ventricular Arrhythmias During Simulated Microgravity

Cohen, Richard J., Massachusetts Inst. of Tech., USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-28 - B-29; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The Cardiovascular Alterations Team is currently conducting studies to determine what alterations in hemodynamic regulation result from sixteen days of simulated microgravity exposure in normal human subjects. In this project we make additional measurements on these same study subjects in order to determine whether there is an increase in susceptibility to ventricular arrhythmias resulting from simulated microgravity exposure. Numerous anecdotal and documented reports from the past 30 years suggest that the incidence of ventricular arrhythmias among astronauts is increased during space flight. For example, documented runs of ventricular tachycardia have been recorded from crew members of Skylab and Mir, there was much attention given by the lay press to Mir Commander Vasily Tslbliyev's complaints of heart rhythm irregularities in July of 1997, and cardiovascular mechanisms may have been causal in the recent death of an experimental primate shortly after return from space. In 1986, a Mir cosmonaut, Alexander Laveikin, was brought home and replaced with an alternate cosmonaut as a result of cardiac dysrhythmias that began during extravehicular activity. Furthermore, at a joint NASA/NSBRI workshop held in January 1998, cardiac arrhythmias were identified as the highest priority cardiovascular risk to a human Mars mission. Despite the evidence for the risk of a potentially lethal arrhythmia resulting from microgravity exposure, the effects of space flight and the associated physiologic stresses on cardiac conduction processes are not known, and an increase in cardiac susceptibility to arrhythmias has never been quantified. In this project, we are determining whether simulated space flight increases the risk of developing life-threatening heart rhythm disturbances such as sustained ventricular tachycardia (defined as ventricular tachycardia lasting at least 30 seconds or resulting in hemodynamic collapse) and ventricular fibrillation. We are obtaining measures of cardiac susceptibility to ventricular arrhythmias in subjects exposed to simulated space flight in the Human Studies Core protocol being conducted by the Cardiovascular Alterations Team, which involves sixteen days .of bed rest. In particular, we are applying a powerful new non-invasive technology, developed in Professor Cohen's laboratory at MIT for the quantitative assessment of the risk of life-threatening ventricular arrhythmias. This technology involves the measurement of microvolt levels of T wave alternans (TWA) during exercise stress, and was recently granted approval by the Food and Drug Administration to be used for the clinical evaluation of patients suspected to be at risk of ventricular arrhythmias. In addition, we are obtaining 24 hour Holter monitoring (to detect non-sustained ventricular tachycardia and to assess heart rate variability). We are also conducting protocols to obtain these same measures on a monthly basis for up to four months in subjects in the Bone Demineralization/calcium Metaboloism Team's long term bed rest study.

Author

Arrhythmia; Cardiovascular System; Hemodynamic Responses; Microgravity; Tachycardia

20000029467 Harvard Medical School, Boston, MA USA

Circadian Entrainment, Sleep-Wake Regulation and Neurobehavioral Performance During Extended Duration Space Flight

Czeisler, Charles A.; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-33 - B-34; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Long-duration manned space flight requires crew members to maintain a high level of cognitive performance and vigilance while operating and monitoring sophisticated instrumentation. However, the reduction in the strength of environmental synchronizers in the space environment leads to misalignment of circadian phase among crew members, coupled with restricted time available to sleep, results in sleep deprivation and consequent deterioration of neurobehavioral function. Crew members are provided, and presently use, long-acting benzodiazepine hypnotics on board the current, relatively brief space shuttle missions to counteract such sleep disruption, a situation that is only likely to worsen during extended duration missions. Given the known carry-over effects of such compounds on daytime performance, together with the reduction in emergency readiness associated with their use at night, NASA has recognized the need to develop effective but safe countermeasures to allow crew members to obtain an adequate amount of sleep. Over the past eight years, we have successfully implemented a new technology for shuttle crew members involving bright light exposure during the pre-launch period to facilitate adaptation of the circadian timing system to the inversions of the sleep-wake schedule often required during dual shift missions. However for long duration space station missions it will be necessary to develop effective and attainable countermeasures that can be used chronically to optimize circadian entrainment. Our current research effort is to study the effects of light-dark cycles with reduced zeitgeber strength, such as are anticipated during long-duration space flight, on the entrainment of the endogenous circadian timing system and to study the effects of a countermeasure that consists of scheduled brief exposures to bright light on the human circadian timing system. The proposed studies are designed to address the following Specific Aims: (1) test the hypothesis that synchronization of the human circadian pacemaker will be disturbed in men and women by the reduction in LD cycle strength. (2) test the hypothesis that this disturbed circadian synchronization will result in the secretion of the sleep-promoting hormone melatonin during the waking day, disturbed sleep, reduced growth hormone secretion, and impaired performance and daytime alertness; (3) as a countermeasure, test the hypothesis that brief daily exposures to bright light (10,000 lux) will reestablish normal entrained circadian phase, resulting in improved sleep consolidation, normalized sleep structure and endogenous growth hormone secretion and enhanced daytime performance. to date, we have carried out twelve experiments to address Hypotheses I and 2 and data analyses are in progress. The results of the current research may have important implications for the treatment of circadian rhythm sleep disorders, such as delayed sleep phase syndrome and shift-work dyssomnia, which are anticipated to have a high incidence and prevalence during extended duration space flight such as planned for the International Space Station and manned missions to Mars.
Author

Circadian Rhythms; Mental Performance; Sleep; Human Performance; Activity Cycles (Biology)

20000029468 Pennsylvania Univ., Philadelphia, PA USA

Countermeasures to Neurobehavioral Deficits from Cumulative Partial Sleep Deprivation During Space Flight

Dinges, David F., Pennsylvania Univ., USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-35 - B-37; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This project is concerned with identifying ways to prevent neurobehavioral and physical deterioration due to inadequate sleep in astronauts during long-duration manned space flight. The performance capability of astronauts during extended-duration space flight depends heavily on achieving recovery through adequate sleep. Even with appropriate circadian alignment, sleep loss can erode fundamental elements of human performance capability including vigilance, cognitive speed and accuracy, working memory, reaction time, and physiological alertness. Adequate sleep is essential during manned space flight not only to ensure high levels of safe and effective human performance, but also as a basic regulatory biology critical to healthy human functioning. There is now extensive objective evidence that astronaut sleep is frequently restricted in space flight to averages between 4 hr and 6.5 hr/day. Chronic sleep restriction during manned space flight can occur in response to endogenous disturbances of sleep (motion sickness, stress, circadian rhythms), environmental disruptions of sleep (noise, temperature, light), and curtailment of sleep due to the work demands and other activities that accompany extended space flight operations. The mechanism through which this risk emerges is the development of cumulative homeostatic pressure for sleep across consecutive days of inadequate sleep. Research has shown that the physiological sleepiness and performance deficits engendered by sleep debt can progressively worsen (i.e., accumulate) over consecutive days of sleep restriction, and that sleep limited to levels commonly experienced by astronauts (i.e., 4 - 6 hr per night) for as little as 1 week, can result in increased lapses of attention, degradation of response times, deficits in complex problem solving, reduced learning, mood disturbance, disruption of essential neuroendocrine, metabolic, and neuroimmune responses, and in some vulnerable persons, the emergence of uncontrolled sleep attacks. The prevention of cumulative performance deficits and neuroendocrine disruption from sleep restriction during extended duration space flight

involves finding the most effective ways to obtain sleep in order to maintain the high-level cognitive and physical performance functions required for manned space flight. There is currently a critical deficiency in knowledge of the effects of how variations in sleep duration and timing relate to the most efficient return of performance per unit time invested in sleep during long-duration missions, and how the nature of sleep physiology (i.e., sleep stages, sleep electroencephalographic [EEG] power spectral analyses) change as a function of sleep restriction and performance degradation. The primary aim of this project is to meet these critical deficiencies through utilization of a response surface experimental paradigm, testing in a dose-response manner, varying combinations of sleep duration and timing, for the purpose of establishing how to most effectively limit the cumulative adverse effects on human performance and physiology of chronic sleep restriction in space operations.
Author
Circadian Rhythms; Metabolism; Neurophysiology; Physiological Responses; Physiology; Sleep; Sleep Deprivation; Mental Performance; Psychomotor Performance; Astronaut Performance

20000029469 Harvard Medical School, Boston, MA USA
Quantitative EEG Monitoring of Vigilance: Effects of Sleep Deprivation, Circadian Phase and Sympathetic Activation
Dijk, Derk-Jan; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-38 - B-39; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Shuttle astronauts typically sleep only 6 to 6.5 hours per day while in orbit. This sleep loss is related to recurrent sleep cycle shifting--due to mission-dependent orbital mechanics and mission duration requirements-- and associated circadian displacement of sleep, the operational demands of space flight, noise and space motion sickness. Such sleep schedules are known to produce poor subjective sleep quality, daytime sleepiness, reduced attention, negative mood, slower reaction times, and impaired daytime alertness. Countermeasures to allow crew members to obtain an adequate amount of sleep and maintain adequate levels of neurobehavioral performance are being developed and investigated. However, it is necessary to develop methods that allow effective and attainable in-flight monitoring of vigilance to evaluate the effectiveness of these countermeasures and to detect and predict online critical decrements in alertness/performance. There is growing evidence to indicate that sleep loss and associated decrements in neurobehavioral function are reflected in the spectral composition of the electroencephalogram (EEG) during wakefulness as well as in the incidence of slow eye movements recorded by the electro-oculogram (EOG). Further-more, our preliminary data indicated that these changes in the EEG during wakefulness are more pronounced when subjects are in a supine posture, which mimics some of the physiologic effects of microgravity. Therefore, we evaluate the following hypotheses: (1) that during a 40-hour period of wakefulness (i.e., one night of total sleep deprivation) neurobehavioral function deteriorates, the incidence of slow eye-movements and EEG power density in the theta frequencies increases especially in frontal areas of the brain; (2) that the sleep deprivation induced deterioration of neurobehavioral function and changes in the incidence of slow eye movements and the spectral composition of the EEG are more pronounced when subjects are in a supine position; and (3) that based on assessment of slow-eye movements and quantitative on-line topographical analyses of EEG during wakefulness an EEG and or EOG parameter can be derived/constructed which accurately predicts changes in neurobehavioral function.
Author
Circadian Rhythms; In-Flight Monitoring; Physiological Effects; Sleep; Sleep Deprivation; Wakefulness

20000029470 Harvard Medical School, Boston, MA USA
On-Line Analysis of Physiologic and Neurobehavioral Variables During Long-Duration Space Missions
Brown, Emery N.; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-40 - B-42; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The goal of this project is to develop reliable statistical algorithms for on-line analysis of physiologic and neurobehavioral variables monitored during long-duration space missions. Maintenance of physiologic and neurobehavioral homeostasis during long-duration space missions is crucial for ensuring optimal crew performance. If countermeasures are not applied, alterations in homeostasis will occur in nearly all-physiologic systems. During such missions data from most of these systems will be either continually and/or continuously monitored. Therefore, if these data can be analyzed as they are acquired and the status of these systems can be continually assessed, then once alterations are detected, appropriate countermeasures can be applied to correct them. One of the most important physiologic systems in which to maintain homeostasis during long-duration missions is the circadian system. to detect and treat alterations in circadian physiology during long duration space missions requires development of: 1) a ground-based protocol to assess the status of the circadian system under the light-dark environment in which crews in space will typically work; and 2) appropriate statistical methods to make this assessment. The protocol in Project 1, Circadian Entrainment, Sleep-Wake Regulation and Neurobehavioral will study human volunteers under the simulated light-dark environment of long-duration space missions. Therefore, we propose to develop statistical models to characterize in near real time circadian and neurobehavioral physiology under these conditions. The specific aims of this project are to test the hypotheses that:

1) Dynamic statistical methods based on the Kronauer model of the human circadian system can be developed to estimate circadian phase, period, amplitude from core-temperature data collected under simulated light- dark conditions of long-duration space missions. 2) Analytic formulae and numerical algorithms can be developed to compute the error in the estimates of circadian phase, period and amplitude determined from the data in Specific Aim 1. 3) Statistical models can detect reliably in near real- time (daily) significant alternations in the circadian physiology of individual subjects by analyzing the circadian and neurobehavioral data collected in Project 1. 4) Criteria can be developed using the Kronauer model and the recently developed Jewett model of cognitive -performance and subjective alertness to define altered circadian and neurobehavioral physiology and to set conditions for immediate administration of countermeasures.
Author
Circadian Rhythms; Physiology; Astronaut Performance; Psychomotor Performance; Mental Performance; Biological Models (Mathematics)

20000029472 Baylor Coll. of Medicine, Houston, TX USA
Space Flight Immunodeficiency
Shearer, William T., Baylor Coll. of Medicine, USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-51 - B-53; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The National Aeronautics and Space Administration (NASA) has had sufficient concern for the well-being of astronauts traveling in space to create the National Space Biomedical Research Institute (NSBRI), which is investigating several areas of biomedical research including those of immunology. As part of the Immunology, Infection, and Hematology Team, the co-investigators of the Space Flight Immunodeficiency Project began their research projects on April 1, 1998 and are now just into the second year of work. Two areas of research have been targeted: 1) specific immune (especially antibody) responses and 2) non-specific inflammation and adhesion. More precise knowledge of these two areas of research will help elucidate the potential harmful effects of space travel on the immune system, possibly sufficient to create a secondary state of immunodeficiency in astronauts. The results of these experiments are likely to lead to the delineation of functional alterations in antigen presentation, specific immune memory, cytokine regulation of immune responses, cell to cell interactions, and cell to endothelium interactions.
Author
Immunity; Immunology; Physiological Responses; Sleep; Sleep Deprivation; Bioastronautics

20000029473 Baylor Coll. of Medicine, Houston, TX USA
Immune Function and Reactivation of Latent Viruses
Butel, Janet S., Baylor Coll. of Medicine, USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-54 - B-56; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A major concern associated with long-duration space flight is the possibility of infectious diseases posing an unacceptable medical risk to crew members. One major hypothesis addressed in this project is that space flight will cause alterations in the immune system that will allow latent viruses that are endogenous in the human population to reactivate and shed to higher levels than normal, which may affect the health of crew members. The second major hypothesis being examined is that the effects of space flight will alter the mucosal immune system, the first line of defense against many microbial infections, including herpesviruses, polyomaviruses, and gastroenteritis viruses, rendering crew members more susceptible to virus infections across the mucosa. We are focusing the virus studies on the human herpesviruses and polyomaviruses, important pathogens known to establish latent infections in most of the human population. Both primary infection and reactivation from latent infection with these groups of viruses (especially certain herpesviruses) can cause a variety of illnesses that result in morbidity and, occasionally, mortality. Both herpesviruses and polyomaviruses have been associated with human cancer, as well. Effective vaccines exist for only one of the eight known human herpesviruses and available antivirals are of limited use. Whereas normal individuals display minimal consequences from latent viral infections, events which alter immune function (such as immunosuppressive therapy following solid organ transplantation) are known to increase the risk of complications as a result of viral reactivations.
Author
Infectious Diseases; Microorganisms; Viral Diseases; Viruses; Bioastronautics

20000029474 Houston Univ., TX USA
DNA Probe Design for Preflight and Inflight Microbial Monitoring
Fox, George E., Houston Univ., USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-57 - B-59; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Crew health is a dominant issue in manned space flight. Microbiological concerns, in particular, have repeatedly emerged as determinants of flight readiness. For example, in at least one case, suspected contamination of the potable water supply nearly

forced a launch delay. In another instance, a crew member's urinary tract infection nearly led to early termination of the mission, in part due to the difficulty of accurately diagnosing the nature of the infection in-flight. Microbial problems are an increasing concern with the trend towards longer-duration missions. It is essential to the success of such missions that systems that deliver acceptable quality of air and water during the anticipated lifetime of the spacecraft be available. As mission duration and resupply intervals increase, it will be necessary to rely on advanced life support systems which incorporate both biological and physical-chemical recycling methods for air and water as well as provide food for the crew. It therefore is necessary to develop real-time, robust, in-flight monitoring procedures that are sensitive enough to detect less than 100 CFU (colony forming units) of bacteria per 100 milliliters of water. It would be desirable if the monitoring system could be readily "reprogrammed" to identify specific pathogens if an in-flight incident were to occur. Thus, the monitoring technology must simultaneously detect many organisms of interest, be subject to miniaturization and be highly automated The long range goal of project is to develop such monitoring systems.
Author
In-Flight Monitoring; Microbiology; Microorganisms; Deoxyribonucleic Acid; Aerospace Medicine

20000029475 Baylor Coll. of Medicine, Houston, TX USA
Neocytolysis: Mechanisms and Limitations
Alfrey, Clarence P., Baylor Coll. of Medicine, USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-60 - B-61; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We uncovered the physiologic process of neocytolysis through attempts to understand the cause of "spaceflight anemia". Astronauts spending just a few days in space invariably return to earth with a 10-15% decrement in their red cell mass. This is not a benign phenomena, rendering the astronaut weak and with orthostatic hypotension on re-entry into a gravitational field. Out studies on SLS-1 and SLS-2 demonstrated normal red cell production during the first days in space, and also there was normal survival of red cells labeled with Cr-58 twelve to fourteen days before launch. Our data could only be explained by the selective hemolysis of red cells younger than twelve days old; the process named "neocytolysis". On entering microgravity, the blood normally held in the extremities pools centrally. This leads to acute central plethora, rapid loss of plasma volume through third space transudation, and a shut-off of erythropoietin elaboration. We suspect that it is the depression of erythropoietin levels below a nadir threshold that precipitates neocytolysis. to confirm this, we studied individuals acclimated to the hypoxic environment at 14,500 feet in the Peruvian Andes. On transport to sea level, we observed the predicted 10-15% fall in red cell mass over seven days, and we found that the neocytolysis was totally prevented by administration of low doses of injected erythropoietin. Also confirming our theories are our studies of hemodialysis patients who suffer a substantial shortening of red cell survival for 7-10 days after erythropoietin therapy is withdrawn. Our current project will expand our understanding of neocytolysis in a number of ways. First we wish to dissect molecular mechanisms underlying the process. We have constructed a theoretic model in which the absence of erythropoietin effects a change in signals from endothelial cells to reticuloendothelial (R-E) phagocytes leading to an altered interaction between RE cells and neocytes. Adhesion molecules selectively expressed by neocytes are targeted. Advancing our theory is the fact that the presence of crythropoietin receptors on certain types of endothelial cells is becoming widely acknowledged (see below). We have invested effort in developing assays for a panel of adhesion molecules and determining which are selectively expressed by neocytes and thus are candidate targets for neocytolysis.
Author
Blood; Erythrocytes; Microgravity; Physiology; Anemias; Microbiology; Cytology; Blood Cells

20000029476 Baylor Coll. of Medicine, Houston, TX USA
GH/IGF-I Transgene Expression on Muscle Homeostasis
Schwartz, Robert J., Baylor Coll. of Medicine, USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-64; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We propose to test the hypothesis that the growth hormone/ insulin like growth factor-I axis through autocrine/paracrine mechanisms may provide long term muscle homeostasis under conditions of prolonged weightlessness. As a key alternative to hormone replacement therapy, ectopic production of hGH, growth hormone releasing hormone (GHRH), and IGF-I will be studied for its potential on muscle mass impact in transgenic mice under simulated microgravity. Expression of either hGH or IGF-I would provide a chronic source of a growth-promoting protein whose biosynthesis or secretion is shut down in space. Muscle expression of the IGF-I transgene has demonstrated about a 20% increase in hind limb muscle mass over control nontransgenic litter mates. These recent experiments, also establish the utility of hind-limb suspension in mice as a workable model to study atrophy in weight bearing muscles. Thus, transgenic mice will be used in hind-limb suspension models to determine the role of GH/IGF-I on maintenance of muscle mass and whether concentric exercises might act in synergy with hormone treatment. As a means to engineer and ensure long-term protein production that would be workable in humans, gene therapy technology will be used by

to monitor muscle mass preservation during hind-limb suspension, after direct intramuscular injection of a genetically engineered muscle-specific vector expressing GHRH. Effects of this gene-based therapy will be assessed in both fast twitch (medial gastrocnemius) and slow twitch muscle (soleus). End-points include muscle size, ultrastructure, fiber type, and contractile function, in normal animals, hind limb suspension, and reambutation.
Author
Hormones; Microgravity; Muscles; Proteins; Weightlessness; Biological Effects; Bioastronautics; Atrophy

20000029477 Harvard Medical School, Boston, MA USA
Pharmacological Inhibitors of the Proteosome in Atrophying Muscles
Goldberg, Alfred, Harvard Medical School, USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-65 - B-67; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

It is now clear that the marked loss of muscle mass that occurs with disuse, denervation or in many systemic diseases (cancer cachexia, sepsis, acidosis, various endocrine disorders) is due primarily to accelerated degradation of muscle proteins, especially myofibrillar components. Recent work primarily in Dr. Goldberg's laboratory had suggested that in these diverse conditions, the enhancement of muscle proteolysis results mainly from activation of the Ub-proteasome degradative pathway. In various experimental models of atrophy, rat muscles show a common series of changes indicative of activation of this pathway, including increases in MRNA for Ub and proteasome subunits, content of ubiquitinated proteins, and sensitivity to inhibitors of the proteasome. In order to understand the muscle atrophy seen in weightlessness, Dr. Goldberg's laboratory is collaborating with Dr. Baldwin in studies to define the changes in these parameters upon hind-limb suspension. Related experiments will explore the effects on this degradative system of exercise regimens and also of glucocorticoids, which are known to rise in space personnel and to promote muscle, especially in inactive muscles. The main goals will be: (A) to define the enzymatic changes leading to enhanced activity of the Ub-proteasome pathway in inactive muscles upon hind-limb suspension, and the effects on this system of exposure to glucocorticoids or exercise; and (B) to learn whether inhibitors of the Ub-proteasome pathway may be useful in retarding the excessive proteolysis in atrophying muscles. Using muscle extracts, Dr. Goldberg's group hopes to define the rate-limiting, enzymatic changes that lead to the accelerated Ub-conjugation and protein degradation. They have recently developed cell-free preparations from atrophying rat muscles, in which Ub-conjugation to muscle proteins is increased above control levels. Because these new preparations seem to reproduce the changes occurring in vivo, they will analyze in depth extracts from normal and atrophying muscles to compare the activities of the Ub-activating enzyme (El), the various LTh-carrier proteins (E2s), and Ub-protein ligases (E3s). Recent studies of other types of muscle wasting -suggest a very important role in muscle proteolysis of certain ubiquitination enzymes, E214k and E3-alpha(i.e. components of the "N-end pathway"). Future studies will focus in understanding their role and test whether they are in fact critical for muscle atrophy in vivo. Since weightlessness leads to a specific loss of contractile proteins and to a switching of myosin isotypes, Dr. Goldberg's group will attempt to identify the ubiquitination enzymes specifically involved in myosin degradation both in normal muscle and after hind-limb suspension.
Author
Atrophy; Enzyme Activity; Enzymes; Muscles; Pharmacology; Proteins; Weightlessness; Bioastronautics

20000029478 Baylor Coll. of Medicine, Houston, TX USA
Molecular Signaling in Muscle Plasticity
Epstein, Henry F., Baylor Coll. of Medicine, USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-69; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Extended spaceflight under microgravity conditions leads to significant atrophy of weight-bearing muscles. Atrophy and hypertrophy are the extreme outcomes of the high degree of plasticity exhibited by skeletal muscle. Stimuli which control muscle plasticity include neuronal, hormonal, nutritional, and mechanical inputs. The mechanical stimulus for muscle is directly related to the work or exercise against a load performed. Little or no work is performed by weight-bearing muscles under microgravity conditions. A major hypothesis is that focal adhesion kinase (FAK) which is associated with integrin at the adherens junctions and costa meres of all skeletal muscles is an integral part of the major mechanism for molecular signaling upon mechanical stimulation in all muscle fibers. Additionally, we propose that myotonic protein kinase (DMPK) and dystrophin (DYSTR) also participate in distinct mechanically stimulated molecular signaling pathways that are most critical in type I and type II muscle fibers, respectively. to test these hypotheses, we will use the paradigms of hindlimb unloading and overloading in mice as models for microgravity conditions and a potential exercise countermeasure, respectively, in mice. We expect that FAK loss-of-function will impair hypertrophy and enhance atrophy in all skeletal muscle fibers whereas DYSTR and DMPK loss-of-function will have similar but more selective effects on Type IT and Type I fibers, respectively. Gene expression will be monitored by muscle-specific creatine kinase M promoter-reporter construct activity and specific MRNA and protein accumulation in the soleus (type I primarily) and plantaris (type 11 primarily) muscles. With these paradigms and assays, the following Specific Project Aims will

be tested in genetically altered mice: 1) identify the roles of DYSTR and its pathway; 2) evaluate the roles of the DMPK and its pathway; 3) characterize the roles of FAK and its pathway and 4) genetically analyze the mechanisms and interactions between the FAK, DYSTR, and DMPK-associated pathways in single and specific combinations of mutants. The identification of potential signaling mechanisms may permit future development of pharmacological countermeasures for amelioration and prevention of the microgravity-induced atrophy in extended spaceflight, and the analysis of both overloading and unloading paradigms may provide further support for development of exercise-based countermeasures. Understanding the basic mechanisms of molecular signaling in muscle plasticity may aid our understanding and treatment of skeletal muscle atrophy not only in spaceflight but in similar problems of the aging population, in prolonged bed rest, and in cachexia associated with chronic disease.
Author
Atrophy; Countermeasures; Microgravity; Muscles; Musculoskeletal System; Bioastronautics

20000029479 Baylor Coll. of Medicine, Houston, TX USA
Activity Dependent Signal Transduction in Skeletal Muscle
Hamilton, Susan L., Baylor Coll. of Medicine, USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-70 - B-72; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The overall goals of this project are: 1) to define the initial signal transduction events whereby the removal of gravitational load from antigravity muscles, such as the soleus, triggers muscle atrophy, and 2) to develop countermeasures to prevent this from happening. Our rationale for this approach is that, if countermeasures can be developed to regulate these early events, we could avoid having to deal with the multiple cascades of events that occur downstream from the initial event. One of our major findings is that hind limb suspension causes an early and sustained increase in intracellular Ca(2+) concentration ([Ca (2+)](sub i)). In most cells the consequences of changes in ([Ca (2+)](sub i))depend on the amplitude, frequency and duration of the Ca(2+) signal and on other factors in the intracellular environment. We propose that muscle remodeling in microgravity represents a change in the balance among several CA(2+) regulated signal transduction pathways, in particular those involving the transcription factors NFAT and NFkB and the pro-apoptotic protein BAD. Other Ca(2+) sensitive pathways involving PKC, ras, rac, and CaM kinase II may also contribute to muscle remodeling.
Author
Atrophy; Microgravity; Muscles; Musculoskeletal System; Proteins; Calcium; Cells (Biology); Cytology; Bioastronautics

20000029480 Harvard Medical School, Boston, MA USA
Molecular Mechanisms Regulating Muscle Fiber Composition Under Microgravity
Rosenthal, Nadia A., Harvard Medical School, USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-73 - B-74; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The overall goal of this project is to reveal the molecular mechanisms underlying the selective and debilitating atrophy of specific skeletal muscle fiber types that accompanies sustained conditions of microgravity. Since little is currently known about the regulation of fiber-specific gene expression programs in mammalian muscle, elucidation of the basic mechanisms of fiber diversification is a necessary prerequisite to the generation of therapeutic strategies for attenuation of muscle atrophy on earth or in space. Vertebrate skeletal muscle development involves the fusion of undifferentiated mononucleated myoblasts to form multinucleated myofibers, with a concomitant activation of muscle-specific genes encoding proteins that form the force-generating contractile apparatus. The regulatory circuitry controlling skeletal muscle gene expression has been well studied in a number of vertebrate animal systems. The goal of this project has been to achieve a similar level of understanding of the mechanisms underlying the further specification of muscles into different fiber types, and the role played by innervation and physical activity in the maintenance and adaptation of different fiber phenotypes into adulthood. Our recent research on the genetic basis of fiber specificity has focused on the emergence of mature fiber types and have implicated a group of transcriptional regulatory proteins, known as E proteins, in the control of fiber specificity. The restriction of E proteins to selected muscle fiber types is an attractive hypothetical mechanism for the generation of muscle fiber-specific patterns of gene expression. to date our results support a model wherein different E proteins are selectively expressed in muscle cells to determine fiber-restricted gene expression. These studies are a first step to define the molecular mechanisms responsible for the shifts in fiber type under conditions of microgravity, and to determine the potential importance of E proteins as upstream targets for the effects of weightlessness. In the past year we have determined that the expression of E Proteins is restricted to specific fiber types by post-transcriptional mechanisms. by far, the most prevalent mechanism of cellular control for achieving post-transcriptional regulation of gene expression is selective proteolysis -through the ubiquitin -proteasome pathway. Steady-state levels of HEB message are similar in all fast and slow skeletal muscle fiber types, yet the protein is restricted to Type IIX fibers. HEB appears to be a nodal point for regulating fiber-specific transcription, as expression of the transcription factor is regulated at the post-transcriptional level. It is not clear at present whether the regulation is at the level of protein synthesis or degradation. We

are now poised to evaluate the biological role of ubiquitination in fiber specific-gene expression by controlling the post-transcriptional expression of E Proteins. The use of metabolic labelling and pharmacological inhibitors of the ubiquitin pathway will be used to identify the mode of regulation of the Type IIX expression pattern. The potential role of specific kinases in effecting the restriction of HEB expression will be examined by using both inhibitors and activators. The results of these studies will provide the necessary information to evaluate the biological role of E proteins in controlling fiber type transitions, and in potentially attenuating the atrophic effects of microgravity conditions. We have also recently shown that ectopic expression of the HEB protein transactivates the Type IIX-specific skeletal a-actin reporter. The 218 bp skeletal a-actin promoter drives transgene expression solely in mature Type IIX fibers. A mouse also carrying the transgene MLCI/HEB (which ectopically expresses the E Protein HEB in Type IIB fibers) forces expression of the skeletal a-actin reporter gene in Type IIB fibers. We can now dissect the composition of this fiber-specific cis-element. The skeletal a-actin promoter is quite compact and has been extensively characterized in vitro for activity and binding factors. The single E box may act as a binding target of myogenic factor/HEB heterodimer to allow for IIX expression. The HEB transcription factor may recognize either the precise flanking sequences of the E Box, or perhaps interacting with other proteins bound nearby, and activating expression in Type IIX fibers. This E box will be both ablated, and alternatively, as ablation may well destroy any muscle-specific transcriptional activity, flanking sequences substituted with those surrounding the E box (El) of the myogenin promoter. Modification of fiber-specific transgene expression will be tested in transgenic mice. The results of these studies will provide basic information on the regulatory circuitry underlying fiber specificity, and will form the basis for building appropriate transgenic regulatory cassettes to effect fiber transitions in subsequent experimental manipulations on unweighted muscles.
Author
Activity (Biology); Atrophy; Cells (Biology); Microgravity; Muscles; Musculoskeletal System; Proteins; Bioastronautics

20000029481 Baylor Coll. of Medicine, Houston, TX USA
Motoneuron Influences on Muscle Atrophy in Simulated Microgravity Induced Muscle Atrophy
Mosier, Dennis R., Baylor Coll. of Medicine, USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-75; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Many alterations in motor unit structure and function occur with exposure to microgravity during spaceflight, and could lead to impaired motor performance. While much work is ongoing to ascertain the nature of biochemical, structural, and physiological changes occurring in muscle fibers, comparatively little attention has been paid to the changes reported in motoneuron terminals at the skeletal neuromuscular junction, and in motoneuron cell bodies, during exposure to microgravity. It is highly unlikely that these changes, whether they occur independently or secondary to changes in the innervated muscle fibers, are without consequences for the regulation of motor unit function. Accordingly, the central hypothesis of this study is that alterations in motoneuron structure and function occur during the process of microgravity-induced muscle atrophy, and that these alterations significantly influence muscle dysfunction, adaptation, and recovery from atrophy induced by microgravity. These changes may be manifested as early structural and functional alterations in the distal motoneuron terminal, in addition to alterations in motoneuron activity produced by changes in stretch reflexes and supraspinal pathways. Initiation of alterations in motoneuron terminals may be influenced by retrograde signals from muscle which induce, as an early event, changes in intracellular calcium and transmitter release. to begin to address these hypotheses, a combination of electrophysiologic assays of transmitter release at neuro-muscular junctions, coupled with electron microscopic assays of junctional remodelling, synaptic vesicles, and intraterminal calcium, is being used to define quantitatively the nature, extent, and possible significance of changes in motoneuron terminals occurring in a mouse model of unloading-induced muscle atrophy. This comprehensive approach is being further extended to determine motoneuronal responses to treatments designed to ameliorate muscle atrophy induced by unloading, and to test the hypothesis that one or more activitydependent factors released locally by skeletal muscle may induce alterations in the presynaptic terminals of innervating motoneurons. The data obtained from this study will be useful in defining the anatomic and physiologic consequences to motoneurons of manipulations which induce muscle atrophy, and will aid in designing further experiments to determine the mechanisms influencing motor unit dysfunction occurring during space travel. Information from this study will be of value to the design and refinement of countermeasures aimed at ameliorating the deleterious effects of microgravity on human motor performance. The results of this work may also provide new insights into important clinical problems such as mechanisms influencing muscle and motor nerve injury encountered in critical care settings, motoneuron dysfunction in devastating neurodegenerative illnesses such as amyotrophic lateral sclerosis, and the design of therapies to retard or prevent muscle atrophy produced by disuse or spinal cord injury.
Author
Atrophy; Microgravity; Musculoskeletal System; Neuromuscular Transmission; Neurons; Muscles; Bioastronautics

20000029482 Johns Hopkins Univ., School of Medicine, Baltimore, MD USA

Context-Specific Adaptation of Gravity-Dependent Vestibular Reflex Responses

Shelhamer, Mark J., Johns Hopkins Univ., USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-80 - B-82; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Stabilization of the eyes and head during body movements is important for maintaining balance and keeping the images of objects stationary on our retinas. Impairment of this ability can lead to disorientation and reduced performance in sensorimotor tasks such as piloting of spacecraft. In the absence of a normal earth gravity field, the dynamics of head stabilization, and the interpretation of vestibular signals that sense gravity and linear acceleration, are subject to change. Transitions between different gravitoinertial force environments - as during different phases of space flight - provide an extreme test of the adaptive mechanisms that maintain these reflexive abilities. It is vitally important to determine human adaptive capabilities in such a circumstance, so that we can know to what extent the sensorimotor skills acquired in one gravity environment will transfer to others. Our work lays the foundation for understanding these capabilities, and for determining how we can aid the processes of adaptation and readaptation. An integrated set of experiments addresses this issue. We use the general approach of adapting some type of reflexive eye movement (saccades, the angular vestibulo-ocular reflex (AVOR), the linear vestibulo-ocular reflex (LVOR)), or the vestibulo-collic reflex (VCR), to a particular change in gain or phase in one condition of gravitoiner-tial force, and adapting to a different gain or phase (or asking for no change) in a second gravitoinertial force condition, and then seeing if the gravitoinertial force itself - the context cue - can recall the previously learned adapted responses. The majority of the experiments in the laboratory use the direction of vertical gaze or the direction of gravity (head tilt) as the context cue. This allows us to study context-specificity in a ground-based setting. One set of experiments, to be performed in parabolic flight, specifically uses the magnitude of gravitoinertial force as a context cue. This is a much better analog of the situation encountered in space flight. Various experiments investigate the behavioral properties, neurophysiological basis, and anatomical substrate of context-specific learning mechanisms. We use otolith (gravity) signals as the contextual cue for switching between adapted states of the saccadic system, the angular and linear vestibulo-ocular reflexes, and the VCR. (By LVOR we mean the oculomotor response - horizontal, vertical, and torsional - to linear translation of the head and body.) We are studying the effect of context on adaptation of saccade gain, phase and gain of the AVOR and LVOR, on ocular counterrolling (OCR) in response to static head tilt, and on head/neck reflexes (VCR) in response to rotation in different orientations. Such research is particularly germane to potential problems of postural and oculomotor control upon exposure to different gravitational environments.

Author

Eye Movements; Gravitation; Gravitational Effects; Neurophysiology; Reflexes; Gravitational Physiology

20000029483 Massachusetts Inst. of Tech., Cambridge, MA USA

Visual Orientation in Unfamiliar Gravito-Inertial Environments

Oman, Charles M., Massachusetts Inst. of Tech., USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-83 - B-85; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The goal of this project is to better understand the process of spatial orientation and navigation in unfamiliar gravito-inertial environments, and ultimately to use this new information to develop effective countermeasures against the orientation and navigation problems experienced by astronauts. How do we know our location, orientation, and motion of our body with respect to the external environment ? On earth, gravity provides a convenient ”down” cue. Large body rotations normally occur only in a horizontal plane. In space, the gravitational down cue is absent. When astronauts roll or pitch upside down, they must recognize where things are around them by a process of mental rotation which involves three dimensions, rather than just one. While working in unfamiliar situations they occasionally misinterpret visual cues and experience striking ”visual reorientation illusions” (VRIs), in which the walls, ceiling, and floors of the spacecraft exchange subjective identities. VRIs cause disorientation, reaching errors, trigger attacks of space motion sickness, and potentially complicate emergency escape. MIR crewmembers report that 3D relationships between modules - particularly those with different visual verticals - are difficult to visualize, and so navigating through the node that connects them is not instinctive. Crew members learn routes, but their apparent lack of survey knowledge is a concern should fire, power loss, or depressurization limit visibility. Anecdotally, experience in mockups, parabolic flight, neutral buoyancy and virtual reality (VR) simulators helps. However, no techniques have been developed to quantify individual differences in orientation and navigation abilities, or the effectiveness of preflight visual. orientation training. Our understanding of the underlying physiology - for example how our sense of place and orientation is neurally coded in three dimensions in the limbic system of the brain - is incomplete. During the 16 months that this human and animal research project has been underway, we have obtained several results that are not only of basic research interest, but which have practical implications for the architecture and layout of spacecraft interiors and for the development of astronaut spatial orientation training countermeasures.

Author

Disorientation; Visual Stimuli; Perceptual Errors; Visual Perception; Attitude (Inclination); Vertical Perception

20000029484 Harvard Medical School, Boston, MA USA

Advanced Techniques for Assessment of Postural and Locomotor Ataxia, Spatial Orientation, and Gaze Stability

Wall, Conrad., III, Harvard Medical School, USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-86 - B-90; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In addition to adapting to microgravity, major neurovestibular problems of space flight include postflight difficulties with standing, walking, turning corners, and other activities that require stable upright posture and gaze stability. These difficulties inhibit astronauts' ability to stand or escape from their vehicle during emergencies. The long-ter7n goal of the NSBRI is the development of countermeasures to ameliorate the effects of long duration space flight. These countermeasures must be tested with valid and reliable tools. This project aims to develop quantitative, parametric approaches for assessing gaze stability and spatial orientation during normal gait and when gait is perturbed. Two of this year's most important findings concern head fixation distance and ideal trajectory analysis. During a normal cycle of walking the head moves up and down linearly. A simultaneous angular pitching motion of the head keeps it aligned toward an imaginary point in space at a distance of about one meter in front of a subject and along the line of march. This distance is called the head fixation distance. Head fixation distance provides the fundamental framework necessary for understanding the functional significance of the vestibular reflexes that couple head motion to eye motion. This framework facilitates the intelligent design of counter-measures for the effects of exposure to microgravity upon the vestibular ocular reflexes. Ideal trajectory analysis is a simple candidate countermeasure based upon quantifying body sway during repeated up and down stair stepping. It provides one number that estimates the body sway deviation from an ideal sinusoidal body sway trajectory normalized on the subject's height. This concept has been developed with NSBRI funding in less than one year. These findings are explained in more detail below. Compared to assessments of the vestibuo-ocular reflex, analysis of vestibular effects on locomotor function is relatively less well developed and quantified. We are improving this situation by applying methodologies such as nonlinear orbital stability to quantify responses and by using multivariate statistical approaches to link together the responses across separate tests. In this way we can exploit the information available and increase the ability to discriminate between normal and pathological responses. Measures of stability and orientation are compared to measures such as dynamic visual acuity and with balance function tests. The responses of normal human subjects and of patients having well documented pathophysiologies are being characterized. When these studies are completed, we should have a clearer idea about normal and abnormal patterns of eye, head, and body movements during locomotion and their stability in a wide range of environments. We plan eventually to use this information to validate the efficacy of candidate neurovestibular and neuromuscular rehabilitative techniques. Some representative studies made during this year are summarized.
Author

Ataxia; Attitude (Inclination); Locomotion; Microgravity; Posture; Stability; Visual Acuity

20000029485 Johns Hopkins Univ., Oncology Center, Baltimore, MD USA

Radiation Effects: Core Project

Dicello, John F., Johns Hopkins Univ., USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-96 - B-98; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The risks to personnel in space from the naturally occurring radiations are generally considered to be one of the most serious limitations to human space missions, as noted in two recent reports of the National Research Council/National Academy of Sciences. The Core Project of the Radiation Effects Team for the National Space Biomedical Research Institute is the consequences of radiations in space in order to develop countermeasure, both physical and pharmaceutical, to reduce the risks of cancer and other diseases associated with such exposures. During interplanetary missions, personnel in space will be exposed to galactic cosmic rays, including high-energy protons and energetic ions with atomic masses of iron or higher. In addition, solar events will produce radiation fields of high intensity for short but irregular durations. The level of intensity of these radiations is considerably higher than that on Earth's surface, and the biological risks to astronauts is consequently increased, including increased risks of carcinogenesis and other diseases. This group is examining the risk of cancers resulting from low-dose, low-dose rate exposures of model systems to photons, protons, and iron by using ground-based accelerators which are capable of producing beams of protons, iron, and other heavy ions at energies comparable to those encountered in space. They have begun the first series of experiments using a 1-GeV iron beam at the Brookhaven National Laboratory and 250-MeV protons at Loma Linda University Medical Center's proton synchrotron facility. As part of these studies, this group will be investigating the potential for the pharmaceutical, Tamoxifen, to reduce the risk of breast cancer in astronauts exposed to the level of doses and particle types expected in space. Theoretical studies are being carried out in a collaboration between scientists at NASA's Johnson Space Center and Johns Hopkins University in parallel with the experimental program have provided methods and predictions which are being used to assess the levels of risks to be encountered and to evaluate appropriate strategies for countermeasures. Although the work in this project is primarily directed toward problems associated with space travel, the problem of protracted exposures to

low-levels of radiation is one of national interest in our energy and defense programs, and the results may suggest new paradigms for addressing such risks.
Author
Cancer; Radiation Effects; Biological Effects; Physiological Effects; Aerospace Medicine; Bioastronautics; Health Physics; Radiation Injuries; Countermeasures

20000029486 Johns Hopkins Univ., Oncology Center, Baltimore, MD USA
Radiation-Induced Cytogenetic Damage as a Predictor of Cancer Risk for Protons and Fe Ions
Williams, Jerry R., Johns Hopkins Univ., USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-99 - B-101; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We have successfully completed the series of experiments planned for year 1 and the first part of year 2 measuring the induction of chromosome aberrations induced in multiple cell types by three model space radiations: Fe-ions, protons and photons. Most of these data have now been compiled and a significant part subjected to detailed data analyses, although continuing data analysis is an important part of our current and future efforts. These analyses are directed toward defining the patterns of chromosomal damage induction by the three radiations and the extent to which such patterns are dependent on the type of cell irradiated. Our studies show significant differences, both quantitatively and qualitatively, between response of different cell types to these radiations however there is an overall pattern that characterizes each type of radiation in most cell lines. Thus our data identifies general dose-response patterns for each radiation for induction of multiple types of chromosomal aberrations but also identifies significant differences in response between some cell types. Specifically, we observe significant resistance for induction of aberrations in rat mammary epithelial cells when they are irradiated in vivo and assayed in vitro. Further, we have observed some remarkable differences in susceptibility to certain radiation-induced aberrations in cells whose genome has been modulated for two cancer- relevant genes, TP53 and CDKNIA. This data, if confirmed, may represent the first evidence of gene-specific differences in cellular metabolism of damage induced by densely-ionizing radiation that confers substantial sensitivity to protons compared to photons.
Author
Cancer; Deoxyribonucleic Acid; Photons; Radiation Damage; Mammary Glands; Ferric Ions; Biological Effects; Aerospace Medicine; Bioastronautics

20000029487 Texas A&M Univ., College Station, TX USA
Quantitation of Radiation Induced Deletion and Recombination Events Associated with Repeated DNA Sequences
Sinden, Richard R., Texas A&M Univ., USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-102 - B-104; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Manned exploration of space exposes the explorers to a complex and novel radiation environment. The galactic cosmic ray and trapped belt radiation (predominantly proton) components of this environment are relatively constant, and the variations with the solar cycle are well understood and predictable. The level of radiation encountered in low earth orbits is determined by several factors, including altitude, inclination of orbit with respect to the equator, and spacecraft shielding. At higher altitudes, and on a Mars mission, the level of radiation exposure will increase significantly. A significant fraction of the dose may be delivered by solar particle events which vary dramatically in dose rate and incident particle spectrum. High-LET radiation is of particular concern. High-LET radiation, a component of galactic cosmic rays (GCR), is comprised of a variety of charged particles of various energies (10 MeV/n to 10 GeV/n), including about 87% photons, 12% helium ions, and heavy ions (including iron). These high energy particles can cause significant damage to target cells. The different particle types and energies result in different patterns of energy deposition at the molecular and cellular level in a primary target cell. They can also cause significant damage to other, nearby cells as a result of secondary particles. Protons, for instance produce secondaries that include photons, neutrons, pions, heavy particles, as well as gamma rays. Heavy ions deposit energy in a ”track” in which the magnitude of the damage varies as the particle loses energy. Heavy ions produce secondary delta rays, or electrons. The distribution of damage through tissue is described by a Bragg curve which will be characteristic for different energies. Needless to say there are differences in the RBE of protons and a particles. High-LET heavy ions are particularly damaging to cells as they do continual damage throughout their track. Differences in these energy deposition patterns can significantly influence the nature of DNA damage and the ability of cellular systems to repair such damage. It has been suspected that these differences also affect the spatial distribution of damage within the DNA of the interphase cell nucleus and produce corresponding differences in endpoints related to health effects. The interaction of a single high-LET particle with chromatin has been suggested to cause multiple double strand breaks within a relatively short distance. In part this is due to the organization of DNA into chromatin fibers in which distant regions of the DNA

helix can be physically juxtaposed by the various levels of coiling of the DNA. This prediction was confirmed by the detection of the generation of double strand DNA fragments of 100-2000 bp following exposure to high-LET ions (including iron).
Author
Deoxyribonucleic Acid; Heavy Ions; Radiation Dosage; Relative Biological Effectiveness (RBE); Biological Effects; Physiological Effects; Radiation Effects; Bioastronautics; Aerospace Medicine

20000029492 Harvard Medical School, Boston, MA USA
Alterations in Cardiovascular Regulation and Function During Long-Term Simulated Microgravity
Cohen, Richard J.; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-117 - B-118; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The Cardiovascular Alterations Team is conducting studies of hemodynamic regulation and susceptibility to arrhythmias resulting from sixteen days of simulated microgravity exposure. In these studies very intensive measurements are made during a short duration of bed rest. In this collaborative effort are making many of the same measurements, however much less frequently, on subjects who are exposed to a much longer duration of simulated microgravity. Alterations in cardiovascular regulation and function that occur during and after space flight have been reported. These alterations are manifested, for example, by reduced orthostatic tolerance upon reentry to the earth's gravity from space. However, the precise physiologic mechanisms responsible for these alterations remain to be fully elucidated. Perhaps, as a result, effective countermeasures have yet to be developed. In addition, numerous reports from the past 30 years suggest that the incidence of ventricular arrhythmias among astronauts is increased during space flight. However, the effects of space flight and the associated physiologic stresses on cardiac conduction processes are not known, and an increase in cardiac susceptibility to arrhythmias has never been quantified. In this project we are applying the most powerful technologies available to determine, in a ground-based study of long duration space flight, the mechanisms by which space flight affects cardiovascular function, and then on the basis of an understanding of these mechanisms to develop rational and specific countermeasures. to this end we are conducting a collaborative project with the Bone Demineralization/Calcium Metabolism Team of the National Space Biomedical Research Institute (NSBRI). The Bone Team is conducting bed rest studies in human subjects lasting 17 weeks, which provides a unique opportunity to study the effects of long duration microgravity exposure on the human cardiovascular system. We are applying a number of powerful new methods to these long term bed rest subjects, including cardiovascular system identification (CSI), microvolt level T wave alternans analysis, and cardiac magnetic resonance imaging to assess non-invasively the effects of simulated long duration space flight on the cardiovascular system.
Author
Arrhythmia; Bone Demineralization; Cardiovascular System; Hemodynamic Responses; Microgravity; Physiological Effects; Biological Effects; Bioastronautics

20000029493 Harvard Medical School, Boston, MA USA
Acute Total and Chronic Partial Sleep Deprivation: Effects on Neurobehavioral Functions, Waking EEG and Renin-Angiotensin System
Dijk, Derk-Jan, Harvard Medical School, USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-119 - B-120; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Total sleep deprivation leads to decrements in neurobehavioral performance and changes in electroencephalographic (EEG) oscillations as well as the incidence of slow eye movements ad detected in the electro-oculogram (EOG) during wakefulness. Although total sleep deprivation is a powerful tool to investigate the association of EEG/EOG and neurobehavioral decrements, sleep loss during space flight is usual only partial. Furthermore exposure to the microgravity environment leads to changes in sodium and volume homeostasis and associated renal and cardio-endocrine responses. Some of these changes can be induced in head down tilt bedrest studies. We integrate research tools and research projects to enhance the fidelity of the simulated conditions of space flight which are characterized by complexity and mutual interactions. The effectiveness of countermeasures and physiologic mechanisms underlying neurobehavioral changes and renal-cardio endocrine changes are investigated in Project 3 of the Human Performance Team and Project 3 of the Cardiovascular Alterations Team respectively. Although the. specific aims of these two projects are very different, they employ very similar research protocols. Thus, both projects investigate the effects of posture/bedrest and sleep deprivation (total or partial) on outcome measures relevant to their specific aims. The main aim of this enhancement grant is to exploit the similarities in research protocols by including the assessment of outcome variables relevant to the Renal-Cardio project in the research protocol of Project 3 of the Human Performance Team and by including the assessment of outcome variables relevant to the Quantitative EEG and Sleep Deprivation Project in the research protocols of Project 3 of the Cardiovascular Alterations team. In particular we will assess Neurobehavioral Function and Waking EEG in the research protocols of the renal-cardio endocrine project and renin-angiotensin and cardiac function in the research protocol of the

Quantitative EEG and Waking Neurobehavioral Function project. This will allow us to investigate two additional specific aims: 1) Test the hypothesis that chronic partial sleep deprivation during a 17 day bed rest experiment results in deterioration of neurobehavioral function during waking and increases in EEG power density in the theta frequencies, especially in frontal areas of the brain, as well as the nonREM- REM cycle dependent modulation of heart-rate variability. 2) Test the hypothesis that acute total sleep deprivation modifies the circadian rhythm of the renin-angiotensin system, changes the acute responsiveness of this system to posture beyond what a microgravity environment alone does and affects the nonREM-REM cycle dependent modulation of heart-rate variability.
Author
Cardiovascular System; Eye Movements; Human Performance; Microgravity; Physiology; Sleep Deprivation; Bioastronautics; Physiological Effects

20000029494 Harvard Medical School, Boston, MA USA
Visual- and Vestibular-Autonomic Influence on Short-Term Cardiovascular Regulatory Mechanisms
Mullen, Thomas J., Harvard Medical School, USA; Ramsdell, Craig D., Harvard Medical School, USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-121 - B-122; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This synergy project was a one-year effort conducted cooperatively by members of the NSBRI Cardiovascular Alterations and Neurovestibular Adaptation Teams in collaboration with NASA Johnson Space Center (JSC) colleagues. The objective of this study was to evaluate visual autonomic interactions on short-term cardiovascular regulatory mechanisms. Based on established visual-vestibular and vestibular-autonomic shared neural pathways, we hypothesized that visually induced changes in orientation will trigger autonomic cardiovascular reflexes. A second objective was to compare baroreflex changes during postural changes as measured with the new Cardiovascular System Identification (CSI) technique with those measured using a neck barocuff. While the neck barocuff stimulates only the carotid baroreceptors, CSI provides a measure of overall baroreflex responsiveness. This study involved a repeated measures design with 16 healthy human subjects (8 M, 8 F) to examine cardiovascular regulatory responses during actual and virtual head-upright tilts. Baroreflex sensitivity was first evaluated with subjects in supine and upright positions during actual tilt-table testing using both neck barocuff and CSI methods. The responses to actual tilts during this first session were then compared to responses during visually induced tilt and/or rotation obtained during a second session.
Author
Autonomic Nervous System; Cardiovascular System; Heart Function; Physiological Responses; Bioastronautics; Bioinstrumentation

20000029495 Harvard Medical School, Boston, MA USA
Sustained Partial Sleep Deprivation: Effects on Immune Modulation and Growth Factors
Mullington, Janet M., Harvard Medical School, USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-123 - B-124; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The vulnerability to medical emergencies is greatest in space where there are real limits to the availability or effectiveness of ground based assistance. Moreover, astronaut safety and health maintenance will be of increasing importance as we venture out into space for extended periods of time. It is therefore critical to understand the mechanisms of the regulatory physiology of homeostatic systems (sleep, circadian, neuroendocrine, fluid and nutritional balance) and the key roles played in adaptation. This synergy project has combined aims of the ”Human Performance Factors, Sleep and Chronobiology Team”; the ”Immunology, Infection and Hematology Team”; and the ”Muscle Alterations and Atrophy Team”, to broadly address the effects of long term sleep reduction, as is frequently encountered in space exploration, on neuroendocrine, neuroimmune and circulating growth factors. Astronaut sleep is frequently curtailed to averages of between 4- 6.5 hours per night. There is evidence that this amount of sleep is inadequate for maintaining optimal daytime functioning. However, there is a lack of information concerning the effects of chronic sleep restriction, or reduction, on regulatory physiology in general, and there have been no controlled studies of the cumulative effects of chronic sleep reduction on neuroendocrine and neuroimmune parameters. This synergy project represents a pilot study designed to characterize the effects of chronic partial sleep deprivation (PSD) on neuroendocrine, neuroimmune and growth factors. This project draws its subjects from two (of 18) conditions of the larger NSBRI project, ”Countermeasures to Neurobehavioral Deficits from Cumulative Partial Sleep Deprivation During Space Flight”, one of the projects on the ”Human Performance Factors, Sleep and Chronobiology Team ”. For the purposes of this study, to investigate the effects of chronic sleep loss on neuroendocrine and neuroimmune function, we have focused on the two extreme sleep conditions from this larger study: a 4.2 hour per night condition, and a 8.2 hour per night condition. During space flight, muscle mass and bone density are reduced, apparently due to loss of GH and IGF-I, associated with microgravity. Since is greater than 70% of growth hormone (GH) is

secreted at night in normal adults, we hypothesized that the chronic sleep restriction to 4 hours per night would reduce GH levels as measured in the periphery. In this synergy project, in collaboration with the "Muscle Alterations and Atrophy Team ", we are measuring insulin-like growth factor-I (IGF-I) in peripheral circulation to test the prediction that it will be reduced by chronic sleep restriction. In addition to stress modulation of immune function, recent research suggests that sleep is also involved. While we all have the common experience of being sleepy when suffering from infection, and being susceptible to infection when not getting enough sleep, the mechanisms involved in this process are not understood and until recently have gone largely overlooked. We believe that the immune function changes seen in spaceflight may also be related to the cumulative effects of sleep loss. Moreover, in space flight, the possibility of compromised immune function or of the reactivation of latent viruses are serious potential hazards for the success of long term missions. Confined living conditions, reduced sleep, altered diet and stress are all factors that may compromise immune function, thereby increasing the risks of developing and transmitting disease. Medical complications, which would not pose serious problems on earth, may be disastrous if they emerged in space.
Author
Endocrine Systems; Infectious Diseases; Neurophysiology; Sleep; Sleep Deprivation; Endocrinology; Biological Effects; Human Reactions; Physiological Effects

20000029551 Fourth Military Medical Univ., Dept. of Aerospace Medicine, Xi'an, China
Effects of 24h - 6 deg. Head-Down Tilt Bed-Rest on Cardiovascular Function and Response to Orthostatic Stress
Yao, Yong-jie, Fourth Military Medical Univ., China; Wu, Xing-yu, Fourth Military Medical Univ., China; Sun, Xi-qing, Fourth Military Medical Univ., China; Hao, Wei-ya, Fourth Military Medical Univ., China; Wei, Ying-bo, Fourth Military Medical Univ., China; Cao, Zin-sheng, Fourth Military Medical Univ., China; Space Medicine and Medical Engineering; December 1999; ISSN 1002-0837; Volume 12, No. 6, pp. 401-404; In Chinese; Copyright; Avail: Issuing Activity

The objective of this study was to investigate the effects of 24 h - 6 degree head-down tilt bed-rest (HDT) on cardiovascular function and response to orthostatic stress. Six degree head-down tilt bed rest for 24 h in 6 healthy males, aged 22-23, were observed. The changes of cardiac function were observed by electrical impedance instrument before and at the 0, 6th, 12th, 18th and 24th hour of HDT, and blood pressure was recorded and urine samples were collected. The changes of cardiovascular response to head up tilt (HUT 90 degree, 10 min) before and post HDT were recorded. During HDT, HR reduced significantly when compared that of pre-HDT(standing). HR at 6th, 12th, and 18 th hour of RDT reduced significantly than that at 0 hour of HDT. Stroke output (SO) and stroke index (CI) at 0th, 6th, 12th and 24th hour of HDT were higher than pre-HDT value. Cardiac output(CO) and cardiac index (CI) at 18 th hour of HDT were significantly lower than those at the beginning of HDT. Total peripheral resistance (TPR) at 18th hour of HDT were higher than that at the beginning of HDT. During HUT before and post HDT, HR, MBP, TPR were significantly increased, SV, SI, CO and CI were significantly reduced. DBP were significantly increased and PP were reduced significantly during HUT post-HDT. Hourly average value of urine during 0 through 4 h were higher than those during 4 through 12 h and 12 through 24 h. 24 h - 6 degree head-down tilt bed rest has significant effects on cardiovascular function and response to HUT in humans.
Author
Cardiovascular System; Heart Function; Physiological Responses; Head Down Tilt; Weightlessness Simulation; Hemodynamic Responses; Blood Circulation; Physiological Effects

20000029552 Naval Medical Research Inst., Shanghai, China
Changes and Its Measurements of Intracellular Ca2+ During Exposure to Hyperbaric Oxygen
Lei, Liu, Naval Medical Research Inst., China; Liu, Jing-chang, Naval Medical Research Inst., China; Lin, Shi-long, Naval Medical Research Inst., China; Li, Bin, Naval Medical Research Inst., China; Space Medicine and Medical Engineering; December 1999; ISSN 1002-0837; Volume 12, No. 6, pp. 410-412; In Chinese; Copyright; Avail: Issuing Activity

The objective of this study is to investigate the rule of change of intracellular Ca2+ and its measurement method during exposure to hyperbaric oxygen (HBO). The microfluorescence method was used to measure the changes of intracellular Ca2+ concentration in co-cultured endothelial cells (EC) and smooth muscle cells (SMC) in a specially designed miniature oxygen chamber. The results are summarized: (1) Ca2+(sub i) changes during HBO exposure can be clearly observed directly in the chamber; (2) Within 5 min during 0.2 MPa and 0.3 MPa HBO exposure, EC[Ca2+(sub i)] and SMC[Ca2+(sub i)] showed a tendency, to increase at first and then decrease with time throughout the exposures, especially the SMC[Ca2+(sub i)]. The EC ruptured under exposure to 0.4MPa HBO. During HBO exposure, EC[Ca2+(sub i)] and SMC[Ca2+(sub i)] showed biphasic changes, which increased at first and then decreased. The technique and method used were reliable and suitable for investigating of intracellular [Ca2+(sub i)] changes under HBO.
Author
Cells (Biology); Calcium; Endothelium; High Pressure Oxygen; Muscles

20000029555 Chinese Academy of Medical Sciences, Headquarters of General Equipment, Beijing, China

Progress in the Protective Medicine Against Rocket Propellants

Hu, Wen-xiang, Chinese Academy of Medical Sciences, China; Tan, Chong-yang, Chinese Academy of Medical Sciences, China; Tan, Sheng-jian, Chinese Academy of Medical Sciences, China; Jiang, Jian, Chinese Academy of Medical Sciences, China; Space Medicine and Medical Engineering; December 1999; ISSN 1002-0837; Volume 12, No. 6, pp. 451-454; In Chinese; Copyright; Avail: Issuing Activity

This article reviews the progress in the major assignment, the organization and implementation of protection against liquid rocket propellant. The safety detection methods of the rocket propellant in the launching field were also discussed. Three steps of the sanitation and protection of the liquid propellant, the toxicity and the toxicology of hydrazine on central nervous system, blood circulatory system, assimilation system, respiratory system, immune system, liver, kidney, eye, skin and its hereditary toxicology were described. In addition, the clinical types of poisoning, the current principle and the common ways of prevention and treatment of hydrazine and nitrogen oxides poisoning were summarized.

Author

Hydrazines; Nitrogen Oxides; Rocket Propellants; Safety; Sanitation; Toxicity; Toxicology; Toxic Hazards; Hazardous Materials; Protection

20000029556 Fourth Military Medical Univ., Dept. of Aerospace Medicine, Xi'an, China

Models for Altitude Decompression Sickness

Zhao, Min, Fourth Military Medical Univ., China; Space Medicine and Medical Engineering; December 1999; ISSN 1002-0837; Volume 12, No. 6, pp. 446-450; In Chinese; Copyright; Avail: Issuing Activity

The objective is to study the probability or risk of decompression sickness in high altitude flight and to establish a probability model. Survival analysis technique was used in the analysis of the information about altitude decompression sickness. It was found that the risk of decompression sickness initially increases up to a certain time point, and then decreases because of denitrogenation. The hazard function may describe the characteristics of this pattern in changes of risk. The parameters of probability models for altitude decompression sickness can be estimated by using the maximum likelihood method. Prediction with the survival models based on the logistic distribution is good.

Author

Decompression Sickness; High Altitude; Probability Theory; Altitude Sickness; Mathematical Models

20000029588 Institute of Space Medico-Engineering, Beijing, China

The Progress in Research on Changes of Central Venous Pressure Under Simulated Weightlessness and Microgravity

Wang, De-sheng, Institute of Space Medico-Engineering, China; Sun, Lei, Institute of Space Medico-Engineering, China; Xiang-Qui-lu, Institute of Space Medico-Engineering, China; Ren, Wei, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; December 1999; ISSN 1002-0837; Volume 12, No. 6, pp. 459-462; In Chinese; Copyright; Avail: Issuing Activity

One of the most profound circulatory changes that occur in man during exposure to microgravity (microG) is a cephalad redistribution of fluid. Central venous pressure (CVP) is not only an important standard for determining the cephalad redistribution of fluid but also the unique valuable means for measuring continuously cardiac filling pressure under simulated weightlessness (SW) and microG, and has a relationship with nerohumoral regulation. With the development of manned spaceflight, the research in space suggested that CVP did not increase, which is directly contradictory to the previous results under SW. This paper mainly discusses the changes of CVP and the effects of countermeasures on CVP under SW and microG, and the mechanisms of decreased CVP under microG. It is postulated that more suitable SW models, more studies about the area of low pressure including especially pulmonary circulation, and comprehensive studies in multiple systems are needed.

Author

Blood Pressure; Microgravity; Pulmonary Circulation; Weightlessness Simulation; Blood Circulation

20000029605 Fourth Military Medical Univ., Faculty of Aviation Medicine, Xi'an, China

The Advances of the Research Work on Lens Cells Using Patch Clamp Technique

Meng, Qing-jun, Fourth Military Medical Univ., China; Space Medicine and Medical Engineering; December 1999; ISSN 1002-0837; Volume 12, No. 6, pp. 456-458; In Chinese; Copyright; Avail: Issuing Activity

The study of lens cells by patch clamp technique began in the early 90's. It shows that the membrane of lens cells possess different types of ionic channels. These channels are responsible for the modulation of the hydration state and transparency of lenses. Several patch clamp configurations have been used to study the activity of ionic channels . The resting potential and

capacitance as we as resistance of different lens cells were also measured. Key words: patch clamp technique; ion currents; vision disorders; crystalline lens
Author
Clamps; Lenses; Eye (Anatomy)

20000029609 Naval General Hospital, Beijing, China
Effects of High Temperature and Noise on Erythrocyte Membrane ATPase Activity in Pilots During Flight
Qin, Shi-zhen, Naval General Hospital, China; Yu, Qi-fu, Naval General Hospital, China; Ma, Gui-xi, Naval General Hospital, China; Hao, Wei-wei, Naval General Hospital, China; Li, ming-gao, Naval General Hospital, China; Zhao, Hong, Naval General Hospital, China; Space Medicine and Medical Engineering; December 1999; ISSN 1002-0837; Volume 12, No. 6, pp. 397-400; In English; Copyright; Avail: Issuing Activity

The objective of this study was to determine the effect of heat and noise on erythrocyte membrane ATPase activities in pilots during flying. Twenty-four pilots performing bombing for 3 h (45 to about 53 C, 122 to about 97dB in the cabin) served as the subjects. 21 ground personnel served as control (27 C in the room). Blood samples were taken from both groups before flying (6: 00 a. m), and immediately (12:00 a. m.) and 8 h (8:00 p.m.) after flying. Na+ - K+ ATPase, and Ca(2+) - Mg(2+) ATPase activities in erythrocyte membrane were determined with colorimetry. The Na+ - K+ ATPase activity in erythrocyte membrane at 6:00 a.m. in the pilots was higher than that in the control group at the same time (Pis less than 0.01). The Ca(2+) - Mg(2+) ATPase activities in erythrocyte membrane at 12:00 a.m. and 8:00 p. m. in pilots were significantly higher, compared with those in control group at the same time (P is less than 0.01). The ATPase values obtained in our study were all within normal range, and the daytime variation of both groups are the same. Exposure of human body to heat and noise for long time may be harmful, the higher ATPase activity there is, the more there will be catabolism of ATP. ATP exhaustion will lead to Ca(2+) overload in erythrocytes thus stiffen the red cell membrane.
Author
Adenosine Triphosphate; Enzyme Activity; Erythrocytes; High Temperature; Temperature Effects; Noise (Sound); Flight Hazards

20000031354 Aeromedical Inst., Soesterberg, Netherlands
Sleep and Alertness Management during Military Operations: Review and Plan of Action ***Final Report***
Simons, M.; Valk, P. J.; Nov. 1999; 47p; In English
Report No.(s): AD-A372731; Rept-1999-K5; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Sleep and alertness management is a major point of attention for commanders and the medical support of military round the clock operations. Awareness on the effects of fatigue and sleepiness should be enhanced both on command level and crew level. Flight surgeons and safety officers should be trained to develop and implement mission specific crew endurance plans. Practical guidelines on methods to prevent serious fatigue and to enhance performance and alertness of the crew play a key role in these crew endurance plans. Useful methods include the use of strategic naps, hypnotics, stimulants, and chronobiotic treatment. In the context of the development of guidelines to optimize performance and alertness during sustained and stressful missions, this literature review describes the available knowledge and identifies areas where knowledge is lacking. In this context military relevant research issues related to the use of strategic naps, hypnotics, stimulants, and chronobiotic treatment are put forward. Based on the results of this study, a work program is drawn up, aimed at developing guidelines to optimize performance and alertness during sustained intensive 0 operations.
DTIC
Alertness; Sleep; Research and Development; Military Operations; Aerospace Medicine

20000031649 Battelle Pacific Northwest Labs., Richland, WA USA
Real-Time 3D Ultrasound for Physiological Monitoring 22258 ***Annual Report, 15 Sep. 1998-14 Sep. 1999***
Littlefield, Richard J.; Oct. 1999; 65p; In English
Contract(s)/Grant(s): DAMD17-94-C-4127
Report No.(s): AD-A373262; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report documents the fourth and fifth years of an ongoing project to develop a prototype 3-D ultrasound telemedicine imaging system. During the first year of the reporting period (FY98), development of a motor driven linear-scan version of the MUSTPAC-2 ultrasound system was completed. One unit of this type has been placed at the National Naval Medical Center (Bethesda, MD) for evaluation in a clinical environment, and a second (ruggedized) unit was sent with the NASA/Yale Everest Extreme Expedition for testing at Mt. Everest Base Camp (elev l7,500 ft) . In addition, research and development was performed leading toward a freehand scan capability. In the second year of the reporting period (FY99), freehand scan capability was developed to a usable prototype level, and one unit of this type was placed at Georgetown University for evaluation. Efforts

continued toward commercialization and routine use, resulting in a new project (at Mercy Hospital, Darby, PA), funded outside DARPA, to complete development of the freehand scan capability and obtain FDA 510(k) approval for MUSTPAC. Project DAMDl7-94-C-4127 is essentially complete at this time, but is formally continuing under a no-cost time extension to allow NNMC further opportunity for their evaluation.
DTIC
Ultrasonics; Medical Services; Digital Systems; Clinical Medicine; Imaging Techniques; Telemedicine

20000031695 Fourth Military Medical Univ., Dept. of Aerospace Medicine, Xi'an, China
Computer Simulation of Cardiovascular Response to Lower Body Negative Pressure
Hao, Wei-ya, Fourth Military Medical Univ., China; Wu, Xing-yu, Fourth Military Medical Univ., China; Zhang, Li-fan, Fourth Military Medical Univ., China; Feng, Lin-hua, Fourth Military Medical Univ., China; Sun, Xi-qing, Fourth Military Medical Univ., China; Yao, Jong-jie, Fourth Military Medical Univ., China; Space Medicine and Medical Engineering; August 1999; ISSN 1002-0837; Volume 12, No. 4, pp. 262-266; In Chinese; Copyright; Avail: Issuing Activity

To simulate the cardiovascular response to lower body negative pressure (LBNP). A computer model was developed. It had 7 subparts: the redistribution of blood, the filling of left ventricle, left ventricle, peripheral circulation, control of heart rate, control of peripheral resistance and control of venous tone. The heart rate and venous tone were controlled by high-pressure receptor baroreflex, while the peripheral resistance was controlled by high- and low-pressure receptor baroreflexes. With the help of the model, cardiovascular response to LBNP up to - 10. 64 kPa (- 80 mmHg) were simulated, including the changes of systolic blood pressure, mean blood pressure, heart rate and cardiac output. The time-dependent response to a LBNP profile was also simulated. The simulation results coincided well with human experiments. The model is valid and can accurately reproduce the short-term hemodynamic response to LBNP. Key words: mathematical model; cardiovascular system; lower body negative pressure; computerize simulation.
Author
Computerized Simulation; Cardiovascular System; Lower Body Negative Pressure; Systolic Pressure; Physiological Responses; Blood Pressure

20000031696 Fourth Military Medical Univ., Dept. of Aviation Medicine, Xi'an, China
Variation of Several Volume Regulating Hormones During 21 d - 6 deg Head -down Bed Rest
Cao, Xin-sheng, Fourth Military Medical Univ., China; Wu, Xing-yu, Fourth Military Medical Univ., China; Sun, Xi-qing, Fourth Military Medical Univ., China; Yao, Yong-jie, Fourth Military Medical Univ., China; Jiang, Chang-lin, Fourth Military Medical Univ., China; Jiang, Shi-zhong, Fourth Military Medical Univ., China; Space Medicine and Medical Engineering; August 1999; ISSN 1002-0837; Volume 12, No. 4, pp. 258-261; In Chinese; Copyright; Avail: Issuing Activity

To investigate variations of plasma renin activity(PRA), aldosterone (Ald) and prostaglandin I2 (PGI2) during 21 d - 6 deg head-down tilt (HDT) with and without lower body negative pressure (LBNP). - 6 deg head-down tilt for 21 d were used to simulate weightlessness. 12 healthy male, aged 23. 7 +/- 5.0, were equally and randomly divided into control group (CON) and LBNP group. The latter subjected to LBNP (- 30 mm Hg, I h/d) in the last week of HDT. Samples of plasma were taken before HDT and on the 2 nd, 4 th, 11 th and 22 nd day during HDT. Compare to control levels, Ald declined significantly on the 2 nd (CON - 30 P less than 0.05; V. S. LBNP - 38 %, p less than 0.01) and increased significantly on the 11 th day(CON + 30 P less than 0.05; LBNP + 48 %, P less than 0.01).PRA reached peak value on the 4th day (P less than 0.05), and decline to below the control level on the 22 nd day. PGI2 increased constantly during HDT, and increased significantly on the 22 nd day (CON P less than 0.01), 11 th, 22 nd (LBNP P less than 0.05). No apparent difference was found between groups after LBNP concerning PRA and Ald; and PGI2 didn't increase further in LBNP group. HDT induced a timely increasing in PRA and Ald , constant increasing in PGI2.
Author
Hormones; Weightlessness Simulation; Vasoconstrictor Drugs; Prostaglandins; Lower Body Negative Pressure

20000031700 Tongji Medical Univ., Inst. of Occupational Medicine, Wuhan, China
Biochemical Changes of Plasma in Paratroops Parachuting: A Preliminary Investigation
Wu, Tang-chun, Tongji Medical Univ., China; Xiong, Yi-li, Hankou Airplane Hospital, China; Chen, Sheng, Tongji Medical Univ., China; Leng, Shun-tang, Tongji Medical Univ., China; Tanguay, Robert M., Laval Univ., Canada; Space Medicine and Medical Engineering; August 1999; ISSN 1002-0837; Volume 12, No. 4, pp. 235-239; In English; Copyright; Avail: Issuing Activity

To study whether physiological and psychological stresses during parachuting jumps may result in biochemical changes of plasma in parachutists. Differences in the levels of hormones (cortisol, growth hormone, insulin, pancreatic glucagon, endothelin,

angiotonin I and II, aldosterone), activities of enzymes (superoxide dismutase, glutathione peroxidase, glutathione S transferase), levels of the free radical damage indicator malondialdehyde (MDA), tumor necrosis factor alpha (TNF-alpha), and the main heat stress protein, HSP70, in the plasma and serum were investigated in control (non-parachuting) and parachuting paratroops. Significantly higher levels of serum hormones such as growth hormone, insulin, angiotonin I, renin activities, as well as NMA and plasma TNF-alpha and HSP70 were observed in the parachuting group. Whether these changes can potentially serve as useful biomarkers to assess possible abnormal stress in parachutists and to evaluate the health condition and to select parachutists remains to be further studied.
Author
Abnormalities; Biochemistry; Parachute Descent; Plasma Chemistry; Pathology; Physiology

20000031709 Institute of Space Medico-Engineering, Beijing, China
Thermodynamic analysis of saturation degree of O2 in myoglobin and hemoglobin
Wu, Qing-cai, Institute of Space Medico-Engineering, China; Wang, Xian-min, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; August 1999; ISSN 1002-0837; Volume 12, No. 4, pp. 298-302; In Chinese; Copyright; Avail: Issuing Activity

To analyze the saturation degree of O2 in myoglobin and hemoglobin. Analysis is based on thermodynamic concepts such as Gibbs free energy, entropy, internal energy and so on. The analytical result were consistent with the results of experiments and analysis made by other authors. The thermodynamic method is feasible in analysing O2 saturation degree in myoglobin and hemoglobin.
Author
Thermodynamics; Evaluation; Dioxides; Myoglobin; Internal Energy; Hemoglobin

20000031710 Shanghai Univ., Inst. of Bio-Medical Engineering, Shanghai, China
Telemedicine: Technology, Application, Evaluation and Prospect
Bao-hua, Wang, Shanghai Univ., China; He, Ping, Shanghai Univ., China; Space Medicine and Medical Engineering; August 1999; ISSN 1002-0837; Volume 12, No. 4, pp. 308-312; In Chinese; Copyright; Avail: Issuing Activity

With the information society drawing near, the pattern of medical treatment is changing.Telemedicine is now carrying out many purposes such as family health care, first aid, expert consultation, long-distance intervene and learning communication in it's particular mode. This article will enter into some engineering-technology methods of medical information transmission (including data, sound and image), introduce several application field of telemedicine, evaluate the potential benefit, virtue and some problems which are likely to arise in the implement of telemedicine, and forecast the development of telemedicine in the future.
Author
Technology Utilization; Telemedicine; Data Transmission

20000031752 Institute of Space Medico-Engineering, Beijing, China
A Digital Simulation Study on the Effect of Change in Cardiovascular System Parameters on the Pulse Waveform of the Radial Artery
Kong, An., Institute of Space Medico-Engineering, China; Bai, Jing, Institute of Space Medico-Engineering, China; Zhang, Ju-peng, Institute of Space Medico-Engineering, China; Xi, Bao-shu, Institute of Space Medico, China; Zu, Pei-zhen, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; August 1999; ISSN 1002-0837; Volume 12, No. 4, pp. 288-292; In Chinese; Copyright; Avail: Issuing Activity

To understand the effect of the change in cardiovascular system parameters on the pressure pulse waveform of the radial artery. A previously developed cardiovascular system mathematical model was used in this simulation study. The parameters used were heart rate, ventricular contractility, arterial compliance, peripheral resistance and blood viscosity. The change in each parameter would influence the pulse waveform. Most of the influences were in agreement with the results of clinical observations reported in the literature. However, several new phenomena were observed. The effect of change in single parameter on the pulse waveform was different for different combinations of other parameter values. It is suggested that the model is useful in studying the relationship between cardiovascular system parameters and pulse waveform of the radial artery.
Author
Research; Cardiovascular System; Arteries; Blood; Pressure Pulses; Digital Simulation

20000031772 American Health Foundation, Inc., Valhalla, NY USA

Development of Liquid Chromatography; Electrospray Ionization; Tandem Mass Spectrometry Methods for Determination of Urinary Metabolites of Benzene in Humans ***Topical Report, Sep. 1994 - Oct. 1997***

Melikian, A. A.; Meng, M.; O'Connor, R.; Hu, P.; Thompson, S. M.; 1999; 60p; In English

Contract(s)/Grant(s): RFA 93-1

Report No.(s): PB2000-102981; HEI/RR-87/99; Copyright; Avail: National Technical Information Service (NTIS)

Occupational exposure to benzene is associated with the development of leukemia and other blood disorders; however, the effects of exposure to low levels of benzene are not well understood. In 1994, the Health Effects Institute (HEI) initiated a research program (the HEI Air Toxics Program) to address uncertainties in the health effects resulting from exposure to ambient levels of toxic air pollutants including benzene. One of the goals of this program was to develop and validate biomarkers of exposure to benzene. There are a number of challenges in identifying suitable markers of recent benzene exposure that are appropriate for epidemiologic studies. First, benzene can be metabolized along a number of different pathways, and some products of benzene metabolism can also be derived from the metabolism of other compounds. Second, data on benzene metabolism in humans are limited, particularly in response to low-dose exposures, and it has been difficult to extrapolate results of controlled exposure studies in animals to the human situation. Third, it is difficult to detect and measure reproducibly the low levels of many benzene metabolites. In response to these concerns, HEI funded Dr. Melikian and colleagues to develop and validate a novel, practical method for assaying metabolites of benzene in humans.

NTIS

Air Pollution; Liquid Chromatography; Ionization; Mass Spectroscopy; Urology; Metabolites; Benzene; Aerospace Medicine

20000031959 Institute of Space Medico-Engineering, Beijing, China

Analysis of Heart Rate Variability During Parallel Swinging

Li, Wei-Gang, Institute of Space Medico-Engineering, China; Yan, Xiao-Xia, Institute of Space Medico-Engineering, China; Pei, Jing-Chen, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Oct. 1999; ISSN 1002-0837; Volume 12, No. 5, pp. 323-327; In Chinese

Report No.(s): CN-11-2774/R; Copyright; Avail: Issuing Activity

The objective is to study the pilots' heart rate variability (HRV) characteristic before, during and after parallel swing and the possibility of evaluating vestibule-vegetative nervous reaction under linear acceleration. 37 healthy male pilots participated in parallel swing test. Dynamic Electrocardiography (ECG) was recorded for 15 min before, during and after swing, using model MR-4500 Holter recorder. All spectra were estimated from 15 min HRV by autoregressive (AR) modeling method, the model order (8 - 15) was chosen using automatic program. The ratio of lower-frequency (LF) to high-frequency (HF) power of HRV spectrum (LF/HF) was computed. The relation between change of those ratios in different swing stage and swing time was analysed. Ratio of LF to HF during swing was markedly lower than those of before and after swing (P is less than 0.01). The vagal nervous activity was markedly increased during swing. There were complexity and versatility in the heart automatic nervous regulation before, during and after swing.

Author

Aerospace Medicine; Heart Rate; Variability

20000031960 Air Force General Hospital, Beijing, China

The Characteristics of Meniere's Disease in Aircrew

Xu, Xian-Rong, Air Force General Hospital, China; Liu, Hua-Feng, Air Force General Hospital, China; Guo, Li-Ying, Air Force General Hospital, China; Space Medicine and Medical Engineering; Oct. 1999; ISSN 1002-0837; Volume 12, No. 5, pp. 368-370; In Chinese

Report No.(s): CN-11-2774/R; Copyright; Avail: Issuing Activity

The objective is to study the characteristics of Meniere's disease in aircrew and its possible influence on space flight. Case studies of Meniere's disease were carried out in 22 pilots. There were vertigo (n = 22), tinnitus (n = 21), abnormal hearing (n = 19) and abnormal vestibular function (n = 11) in 22 pilots. Meniere's disease may hazard the flying in aviation or space and flying may further damage the inner ears of patients with Meniere's disease.

Author

Aerospace Medicine; Diseases; Flight Crews

20000031961 Fourth Military Medical Univ., Dept. of Aerospace Medicine, Xi'an, China

Mechanisms and Detection of G-Induced Loss of Consciousness

Yao, Yong-Jie, Fourth Military Medical Univ., China; Wu, Xing-Yu, Fourth Military Medical Univ., China; Sun, Xi-Qing, Fourth Military Medical Univ., China; Space Medicine and Medical Engineering; Oct. 1999; ISSN 1002-0837; Volume 12, No. 5, pp. 386-390; In Chinese

Report No.(s): CN-11-2774/R; Copyright; Avail: Issuing Activity

High sustained +Gz acceleration induced loss of consciousness (G-LOC) is the main factor that causes flying accident. This paper reviewed the mechanisms and its physiological detection. During slow onset rate (SOR) acceleration, cerebral ischemia/hypoxia are the mechanisms of G-LOC, during rapid onset rate (ROR) acceleration, G-LOC might be related to mechanical intracranial hypertension, but the direct experimental data were lacking. Arterial blood pressure of eye level and cerebral oxygen saturation are important among the physiological indices of G-LOC detection.

Author

Aerospace Medicine; Unconsciousness; Detection

20000031962 Institute of Space Medico-Engineering, Beijing, China

The Use of c-Fos Expression in Vestibular Function Investigation

Liu, Zhi-Qiang, Institute of Space Medico-Engineering, China; Pei, Jing-Chen, Institute of Space Medico-Engineering, China; Kan, Guang-Han, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Oct. 1999; ISSN 1002-0837; Volume 12, No. 5, pp. 381-385; In Chinese

Report No.(s): CN-11-2774/R; Copyright; Avail: Issuing Activity

Certain forms of cellular activation lead to immediate early gene (IEGPs)transcription. The biochemical cascade involving IEGPs has been demonstrated to be an important part that cells response to environmental events. The article reviewed the feature of c-Fos expression in vestibular complexes under stimuli. It was considered that c-Fos expression might be a cue parameter in studying the connection of all vestibular complexes, and to reveal the mechanism of motion sickness.

Author

Aerospace Medicine; Vestibules

20000031963 Institute of Space Medico-Engineering, Beijing, China

Temperature Environment and the Heat Exchange of Astronaut in the Emergency Landing Areas

Wu, Qing-Cai, Institute of Space Medico-Engineering, China; Wang, Xian-Min, Institute of Space Medico-Engineering, China; Jiao, Shu-Jin, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Oct. 1999; ISSN 1002-0837; Volume 12, No. 5, pp. 376-380; In Chinese

Report No.(s): CN-11-2774/R; Copyright; Avail: Issuing Activity

The objective is to analyze the temperature environment of different emergency landing areas and discuss the heat exchange between astronaut and the temperature environment. In addition, countermeasures against the emergency temperature environment were discussed. Heat exchange equation between man and environment was built using the law of energy conservation, and factors that affect the heat balance of human body were discussed. It was found that temperature, humidity, air pressure, velocity of wind and solar radiation are factors affecting the thermal balance of the astronaut. It is important for an astronaut to act properly and use the living devices and the environment conditions correctly during the emergency landing.

Author

Aerospace Medicine; Temperature Measurement; Emergencies; Energy Transfer; Spacecraft Landing

20000031965 Institute of Space Medico-Engineering, Beijing, China

Effects of Extremity Cuffs as a Countermeasure Against the Cardiovascular Deconditioning During 21 d Head-Down Bedrest

Jiang, Shi-Zhong, Institute of Space Medico-Engineering, China; Jiang, Shi-Zhong, Institute of Space Medico-Engineering, China; Li, Jian-Jun, Institute of Space Medico-Engineering, China; Yao, Yong-Jie, Institute of Space Medico-Engineering, China; Wu, Xin-Yu, Institute of Space Medico-Engineering, China; Sun, Xi-Qing, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Oct. 1999; ISSN 1002-0837; Volume 12, No. 5, pp. 364-367; In Chinese

Report No.(s): CN-11-2774/R; Copyright; Avail: Issuing Activity

The objective is to affirm the protective effect of inflated cuffs. The protective effect against the cardiovascular deconditioning of inflated cuffs on the upper parts of thighs and arms during the 1st through 10th days of 21 d bedrest has been reported previously. The effect of the cuffs during the rest of the 21 d bedrest were studied in this paper. Five subjects in cuffs group whose orthostatic tolerance were well maintained continued bedrest for 7 d without inflated cuffs. For the last 4 days of this period,

inflated cuffs were again applied. Orthostatic tolerance of subjects in cuffs group with and without cuffs were measured. Two of the five subjects suffered orthostatic intolerance on the 17th day. No sign of orthostatic intolerance were observed by the end of bedrest. (1) the cardiovascular deconditioning developed when inflated cuffs were not used, and (2) the use of inflated cuffs for 4 d improves the orthostatic tolerance.
Author
Cardiovascular System; Bed Rest; Cuffs; Deconditioning; Head Down Tilt; Aerospace Medicine

20000031974 Institute of Space Medico-Engineering, Beijing, China
Thermal Physiological Analysis of Man in an Intravehicular Activity Space Suit
Yu, Xue-Jun, Institute of Space Medico-Engineering, China; Chang, Shao-Yong, Institute of Space Medico-Engineering, China; Wu, Jian-Min, Institute of Space Medico-Engineering, China; Qiu, Man, Institute of Space Medico-Engineering, China; Wen, Ji-Fu, Institute of Space Medico-Engineering, China; Yang, Tian-De, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Oct. 1999; ISSN 1002-0837; Volume 12, No. 5, pp. 356-359; In Chinese
Report No.(s): CN-11-2774/R; Copyright; Avail: Issuing Activity

The objective is to analyze the thermal physiological changes of man in a Intravehicular Activity (IVA) space suit. Combined second design was used to arrange 24 tests in 6 young male subjects wearing an IVA space suit at sea level. The relationship between common thermal physiological measurements and air ventilating parameters (air temperature, flow rate and its relative humidity) together with metabolic state (rest or work) of man were established in mathematical models. Possible applications of these models were illustrated. Metabolic heat production which influences the relations was also discussed. Thermal physiological changes of man in the space suit were properly expressed by the mathematical models in this paper.
Author
Aerospace Medicine; Thermal Analysis; Physiology; Intravehicular Activity; Space Suits

20000031977 Chinese Air Force, East-Lake Sanatorium, Wuhan, China
Effects of Tea Polyphenols on Microcirculation and Antioxidation in Aircrew
Luo, Xin-Min, Chinese Air Force, China; Hu, Yong-Hun, Chinese Air Force, China; Yu, Jie, Chinese Air Force, China; Wang, Hong, Chinese Air Force, China; Xu, Qing-Yuan, Chinese Air Force, China; Zhan, Hao, Chinese Air Force, China; Space Medicine and Medical Engineering; Oct. 1999; ISSN 1002-0837; Volume 12, No. 5, pp. 338-341; In Chinese
Report No.(s): CN-11-2774/R; Copyright; Avail: Issuing Activity

The objective is to study the effects of tea polyphenols (TP) on bulbi conjunctiva microcirculation (BCM) and antioxidation in aircrew and find out the proper antioxidant for the health protection of aircrew. Forty healthy aircrew were divided into TP group (TP 600 mg/d. Po) and control group (placebo) randomly. The effects of TP on microcirculation and antioxidation in aircrew were tested after 20 days. Red blood cell (RBC) superoxide dismutase (SOD) activity and GSH - PX (Whole blood glutathione peroxidase)/MDA (serum malondialdehyde) ratio in TP group were significantly higher than those in control (P is less than 0.01), and serum MDA level was significantly decreased after TP administration (P is less than 0.05). The numbers of capillaries and blood flow in micrangium were significantly increased, RBC aggregation, ischemia area and A(arteriole)/V(venule) ratio were remarkably decreased in TP group (P is less than 0.01). The total integral value of microcirculation in TP group was Significantly reduced in comparison with that in the control group. TP can significantly increase the antioxidative ability of aircrew, decrease the BCM disturbance and improve the microcirculatory function.
Author
TEA Lasers; Phenols; Circulation; Antioxidants; Aerospace Medicine

20000031979 Institute of Space Medico-Engineering, Beijing, China
Changes in QT Interval of Electrocardiogram Under Gz(+) Acceleration and Its Significance
Wu, Bin, Institute of Space Medico-Engineering, China; Xie, Bao-Sheng, Institute of Space Medico-Engineering, China; Xue, Yue-Ying, Institute of Space Medico-Engineering, China; Lu, Sheng-Qiang, Institute of Space Medico-Engineering, China; You, Guang-Xing, Institute of Space Medico-Engineering, China; Liu, Xing-Hua, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Oct. 1999; ISSN 1002-0837; Volume 12, No. 5, pp. 328-332; In Chinese
Report No.(s): CN-11-2774/R; Copyright; Avail: Issuing Activity

The objective is to define whether QT interval could be used to predict the response of pilots to Gz(+) stress. 37 pilots underwent Gz(+4) acceleration on a human centrifuge. According to their responses to Gz(+) stress, subjects were divided into group A (good reaction group, n = 18), group B (hyperfunction reaction group, n = 14) and group C (inhibition reaction group, n = 1). QT and RR interval were measured pre - , during and post-G. The data of 33 subjects (89.2%) whose QT interval could be measured were analyzed statistically. During Gz(+), QT and RR interval were shortened and sensitivity of QT interval to RR

interval was augmented significantly (vs. pre-G, P is less than 0.001); group B had higher sensitivity of QT interval to RR interval during + Gz (P is less than 0.001, as compared with group A); discrimination functions established by QT and RR interval during Gz(+) were efficient and their accurate judgement rate was 81.8%. The Changes in QT interval of Electrocardiogram (ECG) were related to autonomic nervous imbalance under Gz(+); QT interval and RR interval could be used to predict the response of pilots to Gz(+) stress. These suggested that the parameters and method in this study might be used in G-LOC warning system.
Author
Electrocardiography; Acceleration Stresses (Physiology); Intervals; Aerospace Medicine

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BEHAVIORAL SCIENCES

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

20000027679 Psychometrix Associates, Inc., Lincoln, MA USA
ABAIS: Affect and Belief Adaptive Interface System ***Final Report, Mar. 1998 - Feb. 1999***
Hudlicka, Eva, Psychometrix Associates, Inc., USA; Billingsley, John, Psychometrix Associates, Inc., USA; Feb. 1999; 156p; In English
Contract(s)/Grant(s): F41624-98-C-5032; AF Proj. 3005
Report No.(s): AD-A373270; AFRL-HE-WP-TR-1999-0169; No Copyright; Avail: CASI; A02, Microfiche; A08, Hardcopy

We describe an Affect and Belief Adaptive Interface System (ABAIS) designed to compensate for performance biases caused by users' affective states and active beliefs. The ABMS architecture implements an adaptive methodology consisting of four steps: sensing/inferring user affective state and performance relevant beliefs; identifying their potential impact on performance; selecting a compensatory strategy; and implementing this strategy in terms of specific GUI adaptations. ABAIS provides a generic adaptive framework for exploring a variety of user assessment methods (e.g., knowledge based, self reports, diagnostic tasks, physiological sensing), and GUI adaptation strategies (e.g., content and format based). The ABAIS performance bias prediction is based on empirical findings from emotion research, and knowledge of specific task requirements. The initial ABAIS prototype is demonstrated in the context of an Air Force combat task, uses a knowledge based approach to assess the pilot's anxiety level, and modifies selected cockpit instrument displays in response to detected increases in anxiety levels.
DTIC
Performance Prediction; Physiological Responses; Human Factors Engineering; Decision Support Systems; Adaptation; Combat; Display Devices

20000029471 Massachusetts Inst. of Tech., Cambridge, MA USA
Principal Investigator-in-a-Box
Young, Laurence R., Massachusetts Inst. of Tech., USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-43 - B-44; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Human performance in orbit is currently limited by several factors beyond the intrinsic awkwardness of motor control in weightlessness. Cognitive functioning can be affected by such factors as cumulative sleep loss, stress and the psychological effects of long-duration small-group isolation. When an astronaut operates a scientific experiment, the performance decrement associated with such factors can lead to lost or poor quality data and even the total loss of a scientific objective, at great cost to the sponsors and to the dismay of the Principal Investigator. In long-duration flights, as anticipated on the International Space Station and on any planetary exploration, the experimental model is further complicated by long delays between training and experiment, and the large number of experiments each crew member must perform. Although no documented studies have been published on the subject, astronauts report that an unusually large number of simple errors are made in space. Whether a result of the effects of microgravity, accumulated fatigue, stress or other factors, this pattern of increased error supports the need for a computerized decision-making aid for astronauts performing experiments. Artificial intelligence and expert systems might serve as powerful tools for assisting experiments in space. Those conducting space experiments typically need assistance exactly when the planned checklist does not apply. Expert systems, which use bits of human knowledge and human methods to respond appropriately to unusual situations, have a flexibility that is highly desirable in circumstances where an invariably predictable course of action/response does not exist. Frequently the human expert on the ground is unavailable, lacking the latest information, or not consulted by the astronaut conducting the experiment. In response to these issues, we have developed "Principal Investigator-in-a-Box," or [PI], to capture the reasoning process of the real expert, the Principal Investigator, and combine that with real-time data available in space in order to advise the astronaut about how to proceed in real time. [PI] advises the astronaut during the progress of an experiment in much the same way a real Principal Investigator might do while looking over the

astronaut's shoulder. In its original application, [PI] mimicked several of the tasks of the Principal Investigator, including data quality monitoring, troubleshooting, prescheduling, protocol management and "interesting data" detection. The proposed research focuses on the efficacy of this technique as applied to the data quality monitoring and troubleshooting aspects of [PI]. Author

Artificial Intelligence; Expert Systems; Human Performance; Psychological Effects; Real Time Operation

20000031651 South Carolina Univ., Columbia, SC USA

Contributions to the Development of VE-Assisted Training of Spatial Behavior ***Final Report, 15 Jun. 1999-14 Jan. 2000***

Allen, gary L.; Feb. 01, 2000; 24p; In English

Contract(s)/Grant(s): N00014-99-1-0928

Report No.(s): AD-A373202; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A conceptual analysis for identifying essential spatial skills concluded that three functional families of skills can be identified (object identification, wayfinding and orientation, and target interception/interception avoidance) and that current VE technology is sufficient for their assessment and training. An empirical study of frame of reference control indicated that global and local object frames of reference were more effective than mobile object based and observer based frames in fixed observer situations. An empirical study of distance estimation training showed that skill in estimating metric distance can be trained in the field using either verbal or visual feedback and transferred to a novel field setting.

DTIC

Virtual Reality; Spatial Distribution; Perception; Verbal Communication

20000031731 China Southwest Airlines, Dept. of Steward Medicine, Chengdu, China

Effects of Acute Mild and Moderate Hypoxia on Human Short Memory

Du, Jian-ying, China Southwest Airlines, China; Zhuang, Yong, China Southwest Airlines, China; Li, Xue-yi, China Southwest Airlines, China; Wu, Xing-yu, China Southwest Airlines, China; Wang, Tao, China Southwest Airlines, China; Space Medicine and Medical Engineering; August 1999; ISSN 1002-0837; Volume 12, No. 4, pp. 270-271; In Chinese; Copyright; Avail: Issuing Activity

To investigate the effects of acute mild and moderate hypoxia on human short memory. Tests of pattern memory, scanning memory, continuous recognition memory and space memory were conducted on 18 healthy young male subjects during exposure to 300 m(control),2800 m, 3600 m and 4400 m altitude in hypobaric chamber. Compared to control group, only the performance of continuous recognition memory decreased significantly after exposure to 2800 m for 1 h(P less than 0.05); total reaction time in all tests increased significantly (P less than 0.01) and performance decreased after exposure to 3600 m for 1 h, but the error rates in memory scanning and space memory test were unchanged (P greater than 0.05); during exposure to 4400 m performance of all tests decreased further to about 90.4 %, 93.7 %, 83.3 % and 80.7 % of the control values (P less than 0.01), respectively, and error rate increased significantly too (P less than 0.05). Performance of human short memory decreased after exposure to acute mild and moderate hypoxia for 1 h, and these effects were aggravated with the increase of altitude. Characteristic and threshold of the effect on the various performance tests were different, but increase of reaction time was the first to appear in all cases. Author

Hypoxia; Males; Memory; Performance Tests; Reaction Time; Altitude Simulation

20000031947 Army Aeromedical Research Lab., Fort Rucker, AL USA

Spatial Disorientation Demonstration Flight for U.S. Army Aviators in the TH-67, UH-1, and UH-60 Helicopters ***Final Report***

Estrada, Arthur; Braithwaite, Malcolm G.; Hoffman, Siobhan M.; LeDuc, Patricia A.; Jan. 2000; 71p; In English

Report No.(s): AD-A373633; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Spatial disorientation (SD) occurs when a pilot misperceives the position, motion, or attitude of his or her aircraft. In wartime, the risk of SD is heightened by the extra pressure on sensory and cognitive resources. During Operation Desert Shield/Storm, 81 percent of U.S. Army aviation nighttime accidents were ascribed to SD. An important countermeasure to SD is the aviator's awareness of his physiological vulnerability to SD and the circumstances in which SD is most likely to occur. Consequently, all military aviators must attend courses of instruction in SD. Most student pilots are given instruction during their flight training on how to overcome the effects of SD, but few air services provide a specific SD demonstration sortie to augment ground-based training. An in-flight demonstration of SD reinforces knowledge of the limitations of the orientation senses in flight and enhances aircrew awareness of potentially disorientating situations. Due to anticipated funding and asset changes at the U.S. Army Aviation Center (USAAVNC), Fort Rucker, Alabama, flight training may be affected and undergo revision. In an effort to be responsive

to future training requirements and as the developer of this SD flight training, USAARL is publishing this report containing the SD demonstration flight lesson plans for the TH-67, UH-1, and UH-60 helicopters.
DTIC
Disorientation; Spatial Distribution; UH-1 Helicopter; UH-60A Helicopter; Aircraft Pilots; Sensory Perception

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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..

20000028289 Cornell Univ., Ithaca, NY USA
Extravehicular Activity Suit Systems Design: How to Walk, Talk, and Breathe on Mars
Barton, George, Cornell Univ., USA; Cox, Akio, Cornell Univ., USA; DeFlores, Lauren, Cornell Univ., USA; Garber, Ari, Cornell Univ., USA; Goldsmith, Randall, Cornell Univ., USA; Lee, Brett, Cornell Univ., USA; Mathews, Saemi, Cornell Univ., USA; Diehl, Alison, Cornell Univ., USA; Haenlein, Joel, Cornell Univ., USA; Mitchell, Jonathan, Cornell Univ., USA; Second Annual HEDS-UP Forum; 1999, pp. 55-76; In English; See also 20000028286; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Design parameters for a Mars Extravehicular Mobility Unit (EMU) are different from current space shuttle and past Apollo EMU designs. This report derives functional requirements for the life support, communication, and power subsystems of a Mars EMU from the HEDS reference mission and Mars surface conditions and proposes a design that satisfies all of the currently understood functional requirements for each subsystem. Design for the life support system incorporates 02 storage, possible 02 production, C02 absorption, humidity control, thermal regulation, and radiation protection. The communication system design centers on a reconfigurable wireless network, virtual retinal display, and emergency locator beacons. Portable power options are analyzed, and Direct Methanol Liquid Feed Fuel cells are selected for use in a design that satisfies the power requirements. Mass, cost, and technological readiness are considered for each system. This paper concludes with a recommended combination of subsystem designs that combine to form the primary subsystems of a Mars EMU.
Author
Extravehicular Mobility Units; Functional Design Specifications; Life Support Systems; Mars Surface; Mars (Planet); Manned Mars Missions; Mars Exploration

20000028298 Texas Univ., San Antonio, TX USA
MAGIC: Mars Advanced Greenhouse Integrated Complex
Arizzi, Rocco Vincent, Texas Univ., USA; Bennett, Phillip, Texas Univ., USA; Clare, Sharron, Texas Univ., USA; Forbes, Jacob Edward, Texas Univ., USA; Hernandez, Paul, Jr., Texas Univ., USA; Barricklow, Paul, Texas Univ., USA; Coursen, Garth Edward, Texas Univ., USA; Torres, Charly, Texas Univ., USA; Walsh, Michael James, Texas Univ., USA; Wedel, Dale, Texas Univ., USA; Second Annual HEDS-UP Forum; 1999, pp. 227-246; In English; See also 20000028286; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Human Exploration and Development of Space (HEDS) is a strategic enterprise of the National Aeronautics and Space Administration (NASA). One of the many goals of this initiative is the exploration and colonization of the planet Mars. One approach to this ambitious undertaking is to transport a minimum of resources and utilize as many Martian resources as possible, reducing the overall cost of the mission. A long duration mission, which utilizes in-situ plant growth-facilities, reduces the dependence on consumable supplies from earth. The reduced number of cargo launches required lowers the cost of the project. Additional equipment may then be shipped in place of consumables. Data obtained from growing food on Mars can be used in planning for permanent habitation of the planet. A team of undergraduate students and professors at the University of Texas at San Antonio (UTSA) has developed the Mars Advanced Greenhouse Integrated Complex (MAGIC).
Author
Greenhouses; Vegetation Growth; Consumables (Spacecrew Supplies); Food Production (In Space)

20000028361 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Advanced Air Bag Technology Assessment ***Final Report***

Phen, R. L., Jet Propulsion Lab., California Inst. of Tech., USA; Dowdy, M. W., Jet Propulsion Lab., California Inst. of Tech., USA; Ebbeler, D. H., Jet Propulsion Lab., California Inst. of Tech., USA; Kim, E.-H., Jet Propulsion Lab., California Inst. of Tech., USA; Moore, N. R., Jet Propulsion Lab., California Inst. of Tech., USA; VanZandt, T. R., Jet Propulsion Lab., California Inst. of Tech., USA; April 1998; 278p; In English

Report No.(s): JPL-Publ-98-3; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

As a result of the concern for the growing number of air-bag-induced injuries and fatalities, the administrators of the National Highway Traffic Safety Administration (NHTSA) and the National Aeronautics and Space Administration (NASA) agreed to a cooperative effort that ”leverages NHTSA’s expertise in motor vehicle safety restraint systems and biomechanics with NASA’s position as one of the leaders in advanced technology development... to enable the state of air bag safety technology to advance at a faster pace...” They signed a memorandum of understanding for NASA to ”evaluate air bag performance, establish the technological potential for improved (smart) air bag systems, and identify key expertise and technology within the agency (NASA) that can potentially contribute significantly to the improved effectiveness of air bags.” NASA is committed to contributing to NHTSA’s effort to ”(1) understand and define critical parameters affecting air bag performance, (2) systematically assess air bag technology state of the art and its future potential, and (3) identify new concepts for air bag systems.” The Jet Propulsion Laboratory (JPL) was selected by NASA to respond to the memorandum of understanding by conducting an advanced air bag technology assessment.

Derived from text

Air Bag Restraint Devices; Motor Vehicles; Technology Assessment; Biodynamics

20000029553 Institute of Space Medico-Engineering, Beijing, China

Safety Analysis for Astronaut and the Personal Protective Equipment

Chen, Jin-dun, Institute of Space Medico-Engineering, China; Sun, Jin-biao, Institute of Space Medico-Engineering, China; Shi, He-ping, Institute of Space Medico-Engineering, China; Sun, Hai-long, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; December 1999; ISSN 1002-0837; Volume 12, No. 6, pp. 418-422; In Chinese; Copyright; Avail: Issuing Activity

The objective of this study was to analyze and study astronauts and their personal safety equipment. Three of the most widely used approaches, failure mode and effect analysis (FMEA), fault tree analysis (FTA) and system hazards analysis (SHA) were used. It was demonstrated that astronauts and their personal equipment are subjected to various potential hazards, such as human errors, astronaut illness, fire or space suit emergency decompression, etc. Their causes, mechanisms, possible effects and criticality of some critical potential hazards were analyzed and identified in more details with considerations of the historic accidents of manned spaceflight. The compensating provisions and preventive measures for each hazard were discussed. The analysis study may be helpful in enhancing the astronaut safety and their personal protective equipment.

Author

Astronauts; Space Suits; Aerospace Safety; Flight Safety; Safety Devices

20000029554 Institute of Aviation Medicine, Beijing, China

Technical Consideration of Setting Up a Specification for Human Centrifuge Evaluation of Anti-G Equipment

Zhan, Chang-lu, Institute of Aviation Medicine, China; Geng, Xi-chen, Institute of Aviation Medicine, China; Zhang, Wu-xing, Institute of Aviation Medicine, China; Yan, Gui-ding, Institute of Aviation Medicine, China; Chu, Xu, Institute of Aviation Medicine, China; Space Medicine and Medical Engineering; December 1999; ISSN 1002-0837; Volume 12, No. 6, pp. 441-444; In Chinese; Copyright; Avail: Issuing Activity

Anti-G equipment needs to be evaluated using human centrifuge before further developed. However, there is not a general specification for human centrifuge evaluation of anti-G equipment. From related literature and from our over thirty years experience in this area, we summarize five aspects of technical consideration below: human centrifuge, medical specification for using humans in + Gz stress experiment, anti-G equipment experimental assembly, principles should be applied during human centrifuge evaluation of anti-G equipment. We hope that the technical considerations mentioned in the paper should be helpful to the work of setting up a specification for human centrifuge evaluation anti-G equipment. After we have a specification, the research will be conducted in an orderly manner and the anti-G equipment will be developed.

Author

Antigravity; Human Centrifuges; Specifications; Simulation; Design Analysis; Equipment Specifications

20000029579 Institute of Space Medico-Engineering, Beijing, China

Physiological Basis of Human Mechanics and Its Application in the Design of Pressure Suit

Jia, Si-guang, Institute of Space Medico-Engineering, China; Chen, Jing-shan, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; December 1999; ISSN 1002-0837; Volume 12, No. 6, pp. 436-440; In Chinese; Copyright; Avail: Issuing Activity

The objective of this paper is to discuss the necessity that human mechanics and the physiological basis as applied to the research of human motion in many areas. The motion performance of two aerospace pressure suit were studied. Human mechanics and its physiological basis was applied to the design of one suit only. The result showed that good performance was obtained with the suit designed according to this principle which the stipulated actions could not be performed as well when wearing the suit not so designed. The research of the application of human mechanics and its physiological basis is necessary, has better reality, and is more scientific than applying biomechanics and robotics.

Author

Physiology; Pressure Suits; Space Suits; Bioengineering; Human Performance; Human Body

20000029608 Institute of Aviation Medicine, Beijing, China

Integrated Protection Capability Afforded by a New Type Capstan Anti-G Equipment and Anti-G Straining Maneuver

Geng, Xi-chen, Institute of Aviation Medicine, China; Zhan, Chang-lu, Institute of Aviation Medicine, China; Yan, Gui-ding, Institute of Aviation Medicine, China; Chu, Xu, Institute of Aviation Medicine, China; Lu, Xia, Institute of Aviation Medicine, China; Zhang, Wu-xing, Institute of Aviation Medicine, China; Space Medicine and Medical Engineering; December 1999; ISSN 1002-0837; Volume 12, No. 6, pp. 406-408; In Chinese; Copyright; Avail: Issuing Activity

The objective of this study was to investigate the integrated protection capability afforded by a new type capstan anti-G equipment and anti-G straining maneuver, as a result we discussed the feasibility of protection for 8 G 10 s (rapid onset runs at 2 G/s) acceleration using an associated precept with both of the above anti-G measures. This study was accomplished using the human centrifuge with rapid onset at 2 G/s. First, we determined the relaxed +Gz tolerance of nine male aviation students. We then determined their highest +Gz tolerance for five aviation students using a new type capstan anti-G suit (NKH) and a new type anti-G valve (NKT) + L-1 anti - G straining maneuver (L-1). The other four aviation students used a new type capstan counterpressure suit (NDC) + the new type anti-G valve (NKT) + L-1. The highest + Gz tolerance of five students was 8.80 +/- 0.27 G while using NKH+ NKT+ L-l. This was higher than their relaxed + Gz tolerance at 4.60 +/- 0.42 G (Pis less than 0.01) ; and that the most + Gz tolerance of four students was 8.75 +/- 0.50 G while using NDC + NKT + L- 1 and was higher than their relaxed + Gz tolerance at 4.50 +/- 0.46 G (p is less than 0.01). TA pilot will be capable against the 8 G 10 s (rapid onset runs at 2 G/s) effectively using the new type capstan anti +/- G equipment and anti +/- G straining maneuver, and the provided precept has availability.

Author

Antigravity; Pressure Suits; High Gravity Environments; Acceleration Tolerance

20000030717 Department of the Navy, Washington, DC USA

Footwear Having a Variable Sized Interior

Hall, Robert W., Inventor; Heath, Cleveland A., Inventor; Mack, Alison B., Inventor; Neiley, Roger T., Inventor; Aug. 17, 1999; 5p; In English

Patent Info.: Filed 22 Aug. 97,; US-Patent-Appl-SN-08,919,072; US-Patent-5,937,543

Report No.(s): AD-D019601; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A variable size footwear includes a sole, an upper fixed to the sole and an insole overlying the sole within the upper. An inner sock of elastic material is fixed to the sole and/or insole. The sock in an unstressed state is smaller than the upper, but is expandable to a size conforming to interior walls of the upper. The sock is fixed at an upper edge thereof to the upper.

DTIC

Patents; Shoes; Socks

20000031749 Beijing Univ., Inst. of Man-Machine-Environment, China

Research Progress of Thermal Control System for Extravehicular Activity Space Suit

Wu, Zhi-qiang, Beijing Univ., China; Yuan, Xiu-gan, Beijing Univ., China; Shen, Li-ping, Beijing Univ., China; Space Medicine and Medical Engineering; August 1999; ISSN 1002-0837; Volume 12, No. 4, pp. 303-307; In Chinese; Copyright; Avail: Issuing Activity

New research progress of thermal control system for oversea Extravehicular Activity (EVA)space suit is presented. Characteristics of several thermal control systems are analyzed in detail . Some research tendencies and problems are discussed, which are worthwhile to be specially noted. Finally, author's opinion about thermal control system in the future is put forward. Author

Temperature Control; Extravehicular Activity; Space Suits

20000031877 Department of the Navy, Washington, DC USA

Accelerated Gas Removal from Divers' Tissues Utilizing Gas Metabolizing Bacteria

Kayar, Susan R., Inventor; Axley, Milton J., Inventor; Jul. 13, 1999; 6p; In English; Supersedes US-Patent-Appl-SN-08852207 Patent Info.: Filed 6 May 1997; US-Patent-Appl-SN-08,852,207; US-Patent-5,922,317

Report No.(s): AD-D019557; No Copyright; Avail: US Patent and Trademark Office, Microfiche

This invention relates to a method for biochemical assistance in the decompression of divers using a breathing mixture of oxygen and a nitrogen or hydrogen gas diluent and a product for accomplishing the decompression More particularly, this invention relates to a process for assisting in the removal of hydrogen gas (H2) or nitrogen gas (N2) from the systems of divers breathing H2 or N2 mixtures under hyperbaric conditions and a product for accomplishing decompression assistance. This product and method supplements and accelerates the removal of hydrogen and nitrogen gas that occurs spontaneously during conventional decompression of divers.

DTIC

Diving (Underwater); Underwater Physiology; Pressure Reduction; Underwater Breathing Apparatus; Life Support Systems; Inventions; Patents

20000031893 Michigan Univ., Transportation Research Inst., Ann Arbor, MI USA

Effects of Visual Demand and In-Vehicle Task Complexity on Driving and Task Performance as Assessed by Visual Occlusion, *Sep. 1997 - Sep. 1999*

Tsimhoni, O.; Yoo, H.; Green, P.; Dec. 1999; 82p; In English

Report No.(s): PB2000-102983; UMTRI-99-37; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy

Given the recent proliferation of in-vehicle systems, understanding how drivers deal with the visual demands of driving while operating these systems is essential. to provide such, 16 subjects drove a simulator on roads with long curves of several different radii while providing verbal responses to questions about the content of electronic maps displayed on the center console. In additional sessions, visual demand of the same road segments was measured using the voluntary occlusion technique. Task completion time while driving was correlated with static completion time, generally increasing when the task was performed while driving. It decreased, however, for short tasks, especially when only one glance was made. As driving workload increased, subjects made shorter glances at the display, made more of them, but waited longer between glances. The net effect was a slight decrease in total glance duration (eyes-off-the-road time). As driving workload increased, driving performance became worse.

NTIS

Human Performance; Task Complexity; Human Factors Engineering; Motor Vehicles

20000031925 Tsinghua Univ., Dept. of Engineering Mechanics, Bejing, China

Analysis of Mass Optimization of Manned Spacecraft ECLSS Thermal-Hydraulic Network

Zhang, Xin-Rong, Tsinghua Univ., China; Ren, Jian-Xun, Tsinghua Univ., China; Liang, Xin-Gang, Tsinghua Univ., China; Guo, Zeng-Yuan, Tsinghua Univ., China; Space Medicine and Medical Engineering; Oct. 1999; ISSN 1002-0837; Volume 12, No. 5, pp. 351-355; In Chinese

Report No.(s): CN-11-2774/R; Copyright; Avail: Issuing Activity

The objective is to reduce the weight of manned spacecraft Environment Control and Life Support System (ECLSS). Based on network analysis theory, the flow and thermo-hydraulic network composed of gas and liquid loops in manned spacecraft ECLSS was explored to reduce the weight of ECLSS. The physical models and mathematical models of flow, heat transfer and weight calculation in the network were established. The thermodynamic parameters and weight of the network were calculated on the bases of energy balance, heat transfer relation and the component weight relation. and influencing factors on the system weight were discussed. (1) There is an optimal pipe diameter in the system and the diameter is influenced by flow rate to a large extent; (2) The weight can be reduced by raising inlet temperature properly; (3) The best heat exchange layout makes the weight lightest. Conclusion The obtained results are of importance for reducing launching weight of manned spacecraft.

Author

Mass; Optimization; Environmental Control; Life Support Systems; Network Analysis

20000031964 Institute of Space Medico-Engineering, Beijing, China

On Ergonomics of Spacesuit

Jia, Si-Guang, Institute of Space Medico-Engineering, China; Chen, Jing-Shan, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Oct. 1999; ISSN 1002-0837; Volume 12, No. 5, pp. 371-375; In Chinese

Report No.(s): CN-11-2774/R; Copyright; Avail: Issuing Activity

The concept and the connotation of spacesuit ergonomics are specified. The method of ergonomics was applied to spacesuit design and the design demands for comfort, fitting and space compatibility of spacesuit are indicated systematically by applying anthropometry and building spacesuit size system (including weightlessness). Flexibility and posture of spacesuit are indicated with human mechanics (including weightlessness). The present situation of ergonomic research of spacesuit is discussed simply. Author

Space Suits; Human Factors Engineering; Design Analysis

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.

20000027694 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette France

Zero-in-the-Spectrum Conjecture

Farber, M.; Weinberger, S.; Oct. 1999; 20p

Report No.(s): PB2000-102530; IHES/M/99/81; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We prove that the answer to the ”zero-to-the-Spectrum” conjecture, in its form, suggested by J. Lott, is negative. Namely, we show that for any n is greater than = 6 there exists a closed n-dimensional smooth manifold M(sup n), so that zero does not belong to the spectrum of the Laplace-Beltrami operator acting on the L(sup 2) forms of all degrees on the universal covering M. NTIS

Spectra; Theorem Proving

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.

20000031683 Naval Research Lab., Washington, DC USA

NRL 12-Bit, 213 Msps ADC HSAD9 MCM Evaluation Board

Thai, Khanh; Dec. 08, 1999; 70p; In English

Report No.(s): AD-A373395; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The MCM Evaluation Board is a 6” by 6” test fixture designed for evaluating the HSAD9 MCM, a completely self contained ADC multichip module that digitizes incoming differential analog signals to 12 bit resolution at a 213 Msps maximum sample rate. Data is output through a 50 pin D connector with LYDS logic levels. The MCM Evaluation Board functions very similarly to the AMAD19 12 bit ADC Breadboard. Its circuitry is very similar as well, with the major components that were once on the Breadboard now packaged on the HSAD9 MCM. The MCM is comprised of five major circuit blocks: the AMAD19 custom GaAs HBT circuit, a Calibration FPGA, a non-volatile Ram, two octal, 8 bit DACs, and reference generation circuitry.

DTIC

Analog to Digital Converters; Chips (Electronics); Heterojunction Devices

20000031684 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA

The Design Constraints for the Memory Systems of Useful SMPs *Final Report, Jan.-Dec. 1996*

Pressel, D. M.; Jan. 2000; 27p; In English

Report No.(s): AD-A373394; ARL-TR-2146; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In recent years, many vendors have produced cache coherent shared memory symmetric multiprocessors. While most of the systems that used, at most, eight processors have been successes, the same statement cannot be made for the larger, more scalable systems. Some of the larger systems have been extremely successful, others have been marginally to reasonably successful, and

a few have been outright failures. Based on the author's experience programming the KSR1, Convex Exemplar, Silicon Graphics Inc. (SGI) Challenge and Power Challenge, and the SGI Origin 2000, some insights into key design issues for a successful cache coherent shared memory symmetric multiprocessor are discussed. The report concludes with a frequently overlooked issue; the cost effectiveness of some of these designs. In particular, any design that requires the widespread replication of key data structures will have a hard time establishing its cost effectiveness (even if it does meet the requirements for performance and scalability). DTIC

Multiprocessing (Computers); Memory (Computers); Architecture (Computers); Design Analysis; Central Processing Units

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.

20000028354 Helsinki Univ. of Technology, Espoo, Finland

Journal of Structural Mechanics *Rakenteiden Mekaniikka*

Tuhkuri, J.; 1999; Volume 32, Nos. 1-2; 48p; In Mixed

Report No.(s): PB2000-102680; Copyright; Avail: National Technical Information Service (NTIS)

The paper introduces a product model for transferring data from CAD-applications to FEM-packages. The product data model is presented using EXPRESS (and EXPRESS-G) data definition language (ISO 10303) and the corresponding data is stored using the standard file format ISO-10303-21 (known as STEP-files). The product model is a part of a Knowledge Based approach to the design of steel structures. The pilot programs are written to import the corresponding STEP-file of FST-model (product model including the geometry of the skeleton, exported from CAD) into KB-system, and to export the input file for analyzing programs. The present paper motivates the use of entities needed in the structural analysis of a steel skeleton. Explicit stiffness matrices (based on the solutions of the governing differential equations) are recommended to be used whenever they are available in order to keep the model as small as possible. Similar product models (for geometry and analysis) with slight modifications can be used for other skeletal structures, wood concrete, composite, etc.

NTIS

Structural Analysis; Computer Aided Design

20000028357 Rutherford Appleton Lab., Chilton, UK

OSIRIS (Data Reduction)

Engberg, D., Rutherford Appleton Lab., UK; Nov. 10, 1999; ISSN 1358-6254; 28p; In English

Report No.(s): RAL-TR-1999-068; Copyright; Avail: Issuing Activity

This document presents a technical report on user programs, instrument programs and code listings for OSIRIS (Optical, Spectroscopic and Infrared Remote Imaging System).

CASI

Data Reduction; User Manuals (Computer Programs); Applications Programs (Computers); Infrared Imagery; Spectroscopy

20000028370 Florida Univ., Dept. of Aerospace Engineering, Mechanics and Engineering Science, Gainesville, FL USA

Wavelet and Multiresolution Analysis for Finite Element Networking Paradigms

Kurdila, Andrew J., Florida Univ., USA; Sharpley, Robert C., South Carolina Univ., USA; 1999; 28p; In English

Contract(s)/Grant(s): NAG1-2060; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents a final report on Wavelet and Multiresolution Analysis for Finite Element Networking Paradigms. The focus of this research is to derive and implement: 1) Wavelet based methodologies for the compression, transmission, decoding, and visualization of three dimensional finite element geometry and simulation data in a network environment; 2) methodologies for interactive algorithm monitoring and tracking in computational mechanics; and 3) Methodologies for interactive algorithm steering for the acceleration of large scale finite element simulations. Also included in this report are appendices describing the derivation of wavelet based Particle Image Velocity algorithms and reduced order input-output models for nonlinear systems by utilizing wavelet approximations.

CASI

Wavelet Analysis; Algorithms; Mathematical Models; Finite Element Method; Image Resolution; Computerized Simulation

20000029603 Biodynamic Research Corp., San Antonio, TX USA

HSM-PC Users Guide ***Interim Report, May 1996 - Sep. 1998***

Pancratz, David J., Biodynamic Research Corp., USA; Rogers, Linda J., Biodynamic Research Corp., USA; Bomar, John B., Jr., Biodynamic Research Corp., USA; Sep. 1998; 32p; In English

Contract(s)/Grant(s): F41624-96-C-6010; AF Proj. 3005

Report No.(s): AD-A373472; AFRL-HE-WP-TR-1999-0214; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The Head Spine Model (HSM) originally developed for the UNIX environment was recoded for the personal computer. This recode included code improvements and bug fixes, as well as the development of a graphical interface for creating simulations. The HSM can be used to predict the forces and motions of a human spinal column. The vertebrae are modeled with rigid bodies while hydrodynamic elements model the intevertebral discs. A full set of ligamenteous and active muscular models is also incorporated. External accelerations can be applied to the system and the resulting response calculated. A novel method of calculating an initial equilibrium position was incorporated. Several simulations of frontal and vertical accelerations were conducted to demonstrate the utility of the software. Along with the HSM, a database of spinal element properties was created. This database can be separately used from the software to determine mass, material, and geometric properties of the spinal elements as derived from a variety of sources in the literature. This report details the operation of the GUI interface to create, edit, and run simulations.

DTIC

Computerized Simulation; Mathematical Models; Locomotion; Spine; Computer Programming; Computer Programs

20000030663 Georgia Tech Research Inst., Atlanta, GA USA

Development of CAD Tools for Power Estimation in Continuous-Time and Switched-Capacitor Analog Circuits

Casinovi, Giorgio, Georgia Tech Research Inst., USA; Sep. 1998; 66p; In English

Contract(s)/Grant(s): F33615-95-C-1624; AF Proj. C506

Report No.(s): AD-A373430; AFRL-SN-WP-TR-1998-1105; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

The goal of this research contract was the development of CAD tools to compute statistical information (in particular, mean and variance) about the power dissipated in a continuous-time or switched-capacitor circuit, when statistical information about the input signals to the circuit is given. This approach mirrors the one generally used to estimate power dissipation in digital CMOS circuits. Two power estimation CAD programs were developed: one for continuous-time analog circuits, the other for switched-capacitor circuits. Those tools were integrated into an existing commercial CAD environment, namely CADENCE's Design Framework II.

DTIC

Computer Aided Design; Circuits; Digital Electronics; Switching; Capacitors

20000030666 Bolt, Beranek, and Newman, Inc., Cambridge, MA USA

Embedded Genetic Allocator ***Final Report, Sep. 1997 - Sep. 1999***

Cousins, David B., Bolt, Beranek, and Newman, Inc., USA; Roeber, Fred, Bolt, Beranek, and Newman, Inc., USA; Jan. 2000; 46p; In English

Contract(s)/Grant(s): F30602-97-C-0296; AF Proj. D002

Report No.(s): AD-A373451; NPT-122; AFRL-IF-RS-TR-1999-265; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

This final report documents the work accomplished under the Embedded Genetic Allocator Program, a two year effort funded by DARPA/ITO. The major accomplishment of the program was to develop a new approach to the problem of automatically optimizing the use of memory and processor resources in high performance computing systems consisting of heterogeneous processor nodes connected on a high-speed interconnection fabric. This is frequently known as the mapping problem. The Embedded Genetic Allocation technology developed under this program can provide an automated mapping tool for the design and re-hosting of these systems. The approach developed is automatic and broadly applicable to a wide variety of system architectures. It consists of a hybrid genetic algorithm optimizer (the Embedded Genetic Allocator or EGA), coupled with a software performance monitoring system (various ones can be used). The results presented in this report demonstrate that the EGA can be used to optimize the allocation mappings real-world software, and that the resulting optimizations can rival or even improve upon those generated manually by a skilled programmer.

DTIC

Computer Programs; Computer Aided Mapping; Genetic Algorithms; Computers

20000030695 National Defence Research Establishment, Dept. of Command and Control Warfare Technology, Linkoeping, Sweden

Motion Estimation with Affine Flow ***Roerelseestimering med Affin Floedesmodell***

Hedberg, C.; Jun. 1999; ISSN 1104-9154; 24p; In English

Report No.(s): PB2000-103057; FOA-R-99-01165-616-SE; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

When an algorithm in a system searches for targets in an image from some sort of sensor (e.g., video camera or IR-camera), the algorithm must be fast enough to match the image rate and not prone to false target alarms. The first step towards such an algorithm is to reduce background information without affecting the possible target signatures. For this purpose motion estimation is needed. If the background movement can be defined and is applied when two consecutive frames are subtracted, the result will be the objects that are moving differently in respect to the background (possible targets). The report describes a motion estimation algorithm. The algorithm uses a hierarchical approach to eliminate false matches by using 'large scale' structures, and to achieve a computationally efficient estimation. The estimation model is an affine flow model and is implemented with six parameters. The implemented algorithm uses linear interpolation to calculate the compensated images. Future work is to improve the algorithm to be able to distinguish more than one motionfield to get a more robust estimation.

NTIS

Motion; Image Processing

20000030698 Helsinki Univ. of Technology, Dept. of Computer Science, Helsinki, Finland

Real-Time Garbage Collection of a Functional Persistent Heap

Oksanen, K.; 1999; 118p; In English

Report No.(s): PB2000-102655; TKK-TKO-A-36/99; Copyright; Avail: National Technical Information Service (NTIS)

Traditional database management systems perform updates-in-place and use logs and periodic checkpointing to efficiently achieve atomicity and durability. In this Thesis we shall present a different method, Shades, for achieving atomicity and durability using a copy-on-write policy instead of updates-in-place. We shall also present index structures and the implementation of Shines, a persistent functional programming language, built on top of Shades. Shades includes real-time generational garbage collection. Real-timeness is achieved by collecting only a small part, a generation, of the database at a time. Contrary to previously presented persistent garbage collection algorithms, Shares has no need to maintain metadata (remembered sets) of intra-generation pointers on disk since the metadata can be constructed during recovery. This considerably reduces the amount of disk writing. In conjunction with aggressive commit grouping, efficient index structures, a design specialized to a main memory environment, and a carefully crafted implementation of Shines, we have achieved surprisingly high performance, handsomely beating commercial database management systems.

NTIS

Real Time Operation; Data Base Management Systems

20000030699 Rutherford Appleton Lab., Computational Science and Engineering Dept., Chilton, UK

Impact of High Performance Computing in the Solution of Linear Systems: Trends and Problems

Duff, I. S.; Nov. 11, 1999; ISSN 1358-6254; 30p; In English

Report No.(s): PB2000-102524; RAL-TR-1999-072; Copyright; Avail: National Technical Information Service (NTIS)

We review the influence of the advent of high performance computing on the solution of linear equations. We will concentrate on direct methods of solution and consider both the case when the coefficient matrix is dense and when it is sparse. We will examine the current performance of software in this area and speculate on what advances we might expect in the early years of the next century.

NTIS

Linear Equations; Trends

20000030720 Department of the Navy, Washington, DC USA

A Zeus++ Code Tool, a Method for Implementing Same, and Storage Medium Storing Computer Readable Instructions for Instantiating the Zeus++ Code Tool

Robinson, David F., Inventor; Dec. 01, 1999; 99p; In English

Patent Info.: Filed 1 Dec. 1999; US-Patent-Appl-SN-09,451,718

Report No.(s): AD-D019604; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

The present invention relates generally to software tools for parametric studies with respect to missiles. More specifically, the present invention relates to a software tool which performs parametric studies using Euler and boundary layer solvers and

which generates input data for conventional software analysis tools. Corresponding software and a storage medium for storing same are also disclosed.
DTIC
Patent Applications; Computational Fluid Dynamics; Flow Distribution; Software Development Tools; Software Engineering

20000031598 Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA
Product Line Acquisition in the DoD: The Promise, The Challenges ***Final Report***
Jones, Lawrence G.; Dec. 1999; 26p; In English
Contract(s)/Grant(s): F19628-95-C-0003
Report No.(s): AD-A373184; CMU/SEI-99-TN-011; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Industrial use of software product line technology has resulted in some impressive savings, while also improving product quality and delivery time. Although there has been some successful use of this technology within the Department of Defense (DoD), there are special challenges. This paper presents the basics of product line practices and reports the results of two DoD product line workshops in which important issues and successful practices were shared.
DTIC
Software Engineering; Procedures

20000031626 Army Research Inst. of Environmental Medicine, Natick, MA USA
Fileread: Software Module for Reading Scenario Model Inputs and Observed Data from Text Files
Doherty, T. J.; Feb. 2000; 33p; In English
Report No.(s): AD-A373421; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

SCENARIO is a computer simulation predicting thermal and cardiovascular responses to work in the heat. The present versions of SCENARIO enable model input data to be entered only by keyboard or mouse; there are no mechanisms for obtaining data from electronic files. This limits the use of SCENARIO because manual entry of input data for running multiple simulations or for running simulations in which inputs change many times (i.e., simulations of field and laboratory studies) are very tedious and time consuming. This also precludes the use of parameter optimization to simulate the responses of an individual, which requires direct access to observed data. Comparing model predictions (which are saved in ASCII text files) with observed data (saved in other electronic files) during model development and validation is also extremely tedious. The FILEREAD module described in this report attempts to alleviate these problems. Many simulations can be run in a batch mode through the use of a simulation specification file. For a given simulation, FILEREAD reads model input and observed data that are stored in ASCII tables. Any number of tables may be used to hold the simulation data. The study, test and subject identifiers are defined as key fields for querying records so that more than one study, test, and/or subject may be included in the same file. FILEREAD merges data from more than one file based on date and time fields, which must be sequential within each file for a given study/test/subject combination. Variables may reside in any order in any of the data tables; extraneous variables in tables are ignored. Variables may be specified in a wide variety of units. Each time FILEREAD is called from SCENARIO, model input data describing a single scene or set of input conditions is passed from FILEREAD to SCENARIO. This Technical note serves the purpose of documenting the FILEREAD algorithm and software module.
DTIC
Cardiovascular System; Diagnosis; Computer Techniques; Stress (Physiology); Heat Tolerance

20000031627 Carnegie-Mellon Univ., School of Computer Science, Pittsburgh, PA USA
Developing Theories of Types and Computability via Realizability
Birkedal, Lars; Dec. 28, 1999; 281p; In English
Contract(s)/Grant(s): NSF-CCR94-09997
Report No.(s): AD-A373423; CMU-CS-99-173; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

We investigate the development of theories of types and computability via realizability. In the first part of the thesis, we suggest a general notion of realizability, based on weakly closed partial cartesian categories, which generalizes the usual notion of realizability over a partial combinatory algebra. We show how to construct categories of so-called assemblies and modest sets over any weakly closed partial cartesian category and that these categories of assemblies and modest sets model dependent predicate logic, that is, first-order logic over dependent type theory. We further characterize when a weakly closed partial cartesian category gives rise to a topos. Scott's category of equilogical spaces arises as a special case of our notion of realizability namely as modest sets over the category of algebraic lattices. Thus as a consequence, we conclude that the category of equilogical spaces models dependent predicate logic; we include a concrete description of this model. In the second part of the thesis, we study a notion of relative computability, which allows one to consider computable operations operating on not necessarily computable

data. Given a partial combinatory algebra A, which we think of as continuous realizers, with a subalgebra a is subset of A which we think of as computable realizers, there results a realizability topos RT(A, a), which one intuitively can think of as having continuous objects and computable morphisms. We study the relationship between this topos and the standard realizability toposes RT(A) and RT(a) over A and RT(a). In particular, we show that there is a localic local map of toposes from RT(A, a) to RT(a). to obtain a better understanding of the relationship between the internal logics of RT(A, a) and RT(a), we then provide a complete axiomatization of arbitrary local maps of toposes.
DTIC
Predicate Logic; Computer Programming; Semantics

20000031628 Carnegie-Mellon Univ., Dept. of Computer Science, Pittsburgh, PA USA
The Fox Project: Advanced Development of Systems Software ***Progress Report, 1 Oct.-31 Dec. 1999***
Dec. 31, 1999; 4p; In English
Report No.(s): AD-A373426; F19628-95-C-0050; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The long-term objectives of the Carnegie Mellon Fox Project are to improve the design and construction of systems software and to further the development of advanced programming language technology. We use principles and techniques from the mathematical foundations of programming languages, including semantics, type theory, and logic, to design and implement systems software, including operating systems, network protocols, and distributed systems. Much of the implementation work is conducted in the Standard ML (SML) language, a modern functional programming language that provides polymorphism, first-class functions, exception handling, garbage collection, a parameterized module system, static typing, and a formal semantics. This Project involves several faculty members and spans a wide range of research areas, from (1) advanced compiler development to (2) language design to (3) software system safety infrastructure.
DTIC
Computer Programs; Software Engineering; Programming Languages; Systems Engineering; Semantics; Language Programming

20000031676 Department of the Navy, Washington, DC USA
Model-Based Process for Translating Test Programs
Bearse, Timothy M., Inventor; Lynch, Michael L., Inventor; Souza, James, Inventor; Gagnon, Edward L., Inventor; Sep. 07, 1999; 6p; In English; Supersedes US-Patent-Appl-SN-08713896, AD-D018209.
Patent Info.: Filed 13 Sep. 1996; US-Patent-5,950,004; US-Patent-Appl-SN-08,713,896
Report No.(s): AD-D019548; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A model-based process for translating test programs from a first computer language to a second computer language includes the steps of extracting test strategy and replaceable item callouts from an existing test program in the first language, converting the extracted test strategy into an asymmetric dependency model, converting the dependency model into a model-based test strategy, extracting code segments from the existing test program, translating the extracted code segments into the second language, and merging the model-based test strategy and the translated code segments into a new test program in the second language.
DTIC
Programming Languages; Patents; Mathematical Models

20000031725 Department of the Navy, Washington, DC USA
Computer Program for a Three-Dimensional Volumetric Display
Acantilado, Nell P., Inventor; Aug. 31, 1999; 9p; In English
Patent Info.: Filed 2 Oct. 96,; US-Patent-Appl-SN-08,726,305; US-Patent-5,945,966
Report No.(s): AD-D019565; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A method for transforming world coordinates into device coordinates comprises the steps of inputting a set of world coordinates to be displayed, scaling the world coordinates into view coordinates bounded by a display volume, finding a control memory location of a light beam deflector corresponding to a Y-axis position for each of the view coordinates, calculating X-axis and Z-axis device coordinates from the view coordinates for deflecting a light beam to a selected point within the display volume corresponding to each of the view coordinates, and loading the device coordinates into the control memory locations corresponding to the Y-axis position for each of the view coordinates to cause the light beam to be deflected to each selected point.
DTIC
Computer Programs; Control Units (Computers); Coordinates; Stereophotography; Patents; Inventions

20000031757 Academia Sinica, Yunnan Observatory, Kunming, China

The One-Dimension Centering Algorithms of CCD Image

Ji, Kai-Fan, Academia Sinica, China; Song, Qi-An, Academia Sinica, China; Cao, Wen-Da, Academia Sinica, China; Publications of the Yunnan Observatory; 1996; ISSN 1001-7526, No. 4, pp. 69-74; In Chinese; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The digital centering algorithms with high resolution becomes more and more important in astrometry. The marginal distribution method is used to transform the two-dimensional stellar image to one-dimensional. From comparisons among four kinds of one-dimensional centering algorithms (Gaussian fit, Modified moment, Median and Derivative Search) it is shown that Gaussian fit ranks highest in resolution, then the Modified moment, and Derivative the lowest. But the Gaussian fit is too slow in the view of calculating speed. Therefore, Modified moment is the best choice as a centering method which can meet both the high resolution and high efficiency demands.

Author

Charge Coupled Devices; Algorithms; Images; CCD Cameras

20000031758 Academia Sinica, Yunnan Observatory, Kunming, China

The Comparison of Two Sets of Three Aperture DIMM and Its Result Analysis

Qian, Tong-Ling, Academia Sinica, China; Xu, Jun, Academia Sinica, China; Qin, Xue-Fen, Academia Sinica, China; Publications of the Yunnan Observatory; 1996; ISSN 1001-7526, No. 4, pp. 62-68; In Chinese; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Two sets of three aperture Differential Image Motion Monitor (DIMM) was going to be used for site-testing in Yunnan Area. Before went into convention use, they were compared. In this paper, the comparison results are given. The conclusion is: These two systems can be used for the competition of seeing observation at different site.

Author

Apertures; Image Motion Compensation; Monitors

20000031778 Research Inst. of National Defence, Dept. of Weapons and Protection, Stockholm, Sweden

XSPEC. A Delphi Program for Data Collection

Oestmark, H.; Launila, O.; Mar. 1999; ISSN 1104-9154; 28p; In English

Report No.(s): PB2000-103091; FOA-R-01099-310-SE; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

A data collection program has been written in DELPHI 3 and tested in a BOXCAR-based data sampling system. The program runs on a PV (Windows 95/98 or Windows NT), equipped with a GPIB card. The program has been tested in a sampling system consisting of a DG 535 delay generator, a SRS 250 Boxcar integrator, a SPEX 500M or 1000M monochromator and a Lambda Physik LPX 300 + LPD 3000 dye laser system. The different routines in the program are commented in the program code.

NTIS

Data Acquisition; Computer Programs; Language Programming

20000031867 Knowledge Evolution, Inc., Washington, DC USA

Formal Alternatives Management Integrating Logical Inference and Rationale (Familiar) ***Final Report, Aug. 1996 - Dec. 1999***

Bailin, Sidney C.; Allemang, Dean T.; Jan. 2000; 37p; In English

Contract(s)/Grant(s): F30602-96-C-0284; AF Proj. D899

Report No.(s): AD-A373730; AFRL-IF-RS-TR-2000-4; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The FAMILIAR project goals were to: (1) position software design rationale capture in the context of alternatives management, i.e., systematic exploration of design alternatives and their trade-offs against the goals of the system under development; and (2) formalize the capture and presentation of design rationale through Functional Representation. The FAMILIAR technology is a union of alternatives management and Functional Representation. It is based on earlier technologies. KAPTUR and ZD 1, which explored these respective approaches. FAMILIAR built on lessons learned from those systems and provided a more robust tool that supports a range of rationale capture situations from completely informal to fully formal. FAMILIAR also supports the evolution towards increasing formalism as a domain matures.

DTIC

Systems Engineering; Software Engineering; Formalism; Systems Analysis; Data Management; Computer Aided Design

20000031874 Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA
Construction and Deployment Scripts for COTS-Based, Open Source Systems ***Final Report***
Hansen, Wilfred J.; Jan. 2000; 98p; In English
Contract(s)/Grant(s): F19628-95-C-0003
Report No.(s): AD-A373330; CMU/SEI-99-TR-013; ESC-TR-99-013; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

Construction/deployment scripts direct the compilation of sources to executables and the installation of those executables. This report details the construction/deployment scripts developed at the Software Engineering Institute for the GEE project. GEE, a Generic Enterprise Ensemble, is a prototypical three tier information system incorporating a number of commercial off the shelf (COTS) products. The scripts for GEE were challenging because we wanted a self contained package of scripts and source files from which the system could be built and deployed either by us at our site or by customers at their sites. The COTS products we used Java, an Oracle database, the Visibroker implementation of CORBA (the Common Object Request Broker Architecture), and the Netscape Web browser and server added challenges in installation, version change, process initiation, and communication rendezvous. This report describes the challenges and how our solutions exploited the principles of repeat not and delay binding. Lessons learned are reported elsewhere.
DTIC
Software Engineering; Information Systems; Client Server Systems; Computer Programming

20000031875 Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA
Lessons Learned Collaborating on a Process for SPI at Xerox ***Final Report***
Fowler, Priscilla; Middlecoat, Brian; Yo, Sung; Dec. 1999; 70p; In English
Report No.(s): AD-A373332; CMU/SEI-99-TR-006; ESC-TR-99-006; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

During 1995-1998, Xerox Corporation's West Coast Production Systems Group (PSG West) worked with the Software Engineering Institute (SEI) to apply the prototype Process Change Model (PCM) to aid in their efforts to reach Level 2 of the Software Capability Maturity Model(registered) (CMM(registered), and to develop the generic processes required for Level 3. The Process Change Model, along with a companion guidebook, was designed to provide the basis for a systematic approach to technology specific change based in part on whole product principles, with a focus on one Key Process Area (KPA) at a time. This report describes a collaborative effort to develop a more systematic and detailed approach to software process improvement (SPI) through use and evaluation of prototype versions of the PCM and guidebook. In particular, the work of the PSG West software engineering process group (SEPG) to apply the PCM and guidebook in working with improvement action teams focused on the KPAs of the Software CMM is described. Lessons learned about the live evaluation and maturation of a new process and guidebook such as this are presented. These lessons should be of interest to those engaged in work on technology maturation and the adoption of technological or process innovations as well as to those engaged in SPI and process development.
DTIC
Project Management; Computer Programming; Software Development Tools

20000032018 Communications Research Lab., Tokyo, Japan
Precise Positioning Technique Using GPS, 6, Analysis Software
Kawase, Seiichirou, Communications Research Lab., Japan; Takahashi, Yukio, Communications Research Lab., Japan; Review of the Communications Research Laboratory; Dec. 1993; ISSN 0914-9279; Volume 39, No. 4, pp. 243-246; In Japanese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This paper describes the development of an analysis software program for differential GPS geodesy. This program can be used to estimate the positions of unknown receiving points relative to known receiving points. The input data to the program are differential pseudo-range of satellites and orbital elements received from the satellites. The unknown parameters to be estimated are longitude, latitude, height, and relative offset/drift in receiver clocks. The estimates are obtained by using the classical batch-processing least-square method.
Author
Global Positioning System; Positioning; Computer Programs; Receivers

20000032019 Communications Research Lab., Tokyo, Japan
Precise Positioning Technique Using GPS, 5, Development of Automatic Operation Software and Pre-Processor Software
Kaneko, Akihiro, Communications Research Lab., Japan; Imae, Michito, Communications Research Lab., Japan; Kiuchi, Hitoshi, Communications Research Lab., Japan; Sugimoto, Yuji, Communications Research Lab., Japan; Review of the

Communications Research Laboratory; Dec. 1993; ISSN 0914-9279; Volume 39, No. 4, pp. 237-242; In Japanese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

”PRESTAR” is a precise ground survey and orbit determination receiver for the Global Positioning System (GPS). It uses a directional antenna for signal receiving from the GPS satellites and basically doesn’t use the code information of the pseudo random noise sequences of the ranging signal for phase measurements of P code clocks and carrier signals. This paper describes the control software for the receiver and the real time data processing software. And also the off-line data processing for the determination of each signal phase from received signal to calculate the pseudo-range for the data analysis of the base-line vector and the orbit determination.

Author

Positioning; Global Positioning System; Receivers; Computer Programs

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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.

20000027683 Department of Defense, Office of Inspector General, Arlington, VA USA

Air Force Logistics Year 2000 End-to-End Test Planning

Young, Shelton R., Department of Defense, USA; Schraden, Tilghman A., Department of Defense, USA; Austin, Joseph M., Department of Defense, USA; Avers, Marc E., Department of Defense, USA; Ickes, Douglas P., Department of Defense, USA; Oct. 26, 1999; 26p; In English

Report No.(s): AD-A373312; IG/DOD-00-021; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The audit objective was to evaluate the effectiveness of the Y2K end-to-end tests planned for the logistics functional area. This report, the second in a series on logistics end-to-end testing, addresses the overall Level II end-to-end test planning accomplished by the Air Force.

DTIC

Logistics; Management Planning; Computer Information Security; Computer Program Integrity

20000029602 Tulsa Univ., Dept. of Mathematics and Computer Science, OK USA

Travel Support for the Thirteenth Annual IFIP WG 11.3 Conference on Database Security ***Final Report, 1 Jul. - 31 Dec. 1999***

Shenoi, Sujeet, Tulsa Univ., USA; Jan. 28, 2000; 4p; In English

Contract(s)/Grant(s): N00014-99-1-0632

Report No.(s): AD-A373460; No Copyright; Avail: CASI; A01, Microfiche; A01, Hardcopy

The Thirteenth Annual WG 11.3 Conference on Database Security was held in Seattle, Washington on July 26-28, 1999. The goals were (1) to provide a forum for the international computer security community to discuss the current state of research and practice in database and information systems security, (2) To enable participants to expand their knowledge through personal contact with other researchers and practitioners, and (3) to disseminate the results of the conference and accompanying discussions, including original research, practical experiences and innovative ideas. A copy of the conference proceedings is included as an appendix to this report. Revised versions of the papers and the minutes of the panel discussions will be published as a book: Research Advances in Database and Information Systems Security, V. Atluri and J. Hale (Eds.), Kluwer, Norwell, Massachusetts, 2000. The ONR grant subsidized the travel expenses of eighteen participants, most of them were faculty members or students who might not have been able to attend the conference without travel support. To increase student participation and foster interaction with senior researchers, the grant covered all the expenses incurred by the three graduate student attendees.

DTIC

Data Bases; Computer Information Security; Data Management

20000030687 Department of Defense, Office of Inspector General, Arlington, VA USA

Year 2000 Higher Level Testing Schedule Data Reported to DOD

Oct. 20, 1999; 21p; In English

Report No.(s): AD-A373349; IG/DOD-00-015; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The overall audit objective was to determine whether DoD mission critical systems are being appropriately scheduled for higher level year 2000 testing. Specifically, the audit compared the inventory of mission critical systems to the list of systems

scheduled for higher level testing and assessed the controls for assuring compliance with statutory and DoD Year 2000 Management Plan requirements. This audit did not address 365 intelligence or special operations systems, which are being reviewed separately.
DTIC
Computer Program Integrity; Program Verification (Computers); Computer Networks; Computer Systems Performance

20000031342 Space and Naval Warfare Systems Command, San Diego, CA USA
Commercial Off-the-Shelf (COTS) Security Products Evaluation Process ***Final Report***
Yen, J.; Jan. 2000; 54p; In English
Report No.(s): AD-A373568; SPAWAR/CA-TD-3100; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
This document describes the commercial off-the-shelf (COTS) security product evaluation process, defines the seven phases of the evaluation process, outlines the documentation requirements of the process, and discusses how the evaluation process fits into the overall evaluation framework. The evaluation process as described in this document is expected to be revised as the overall evaluation framework is developed. Appendix A contains additional information regarding Common Criteria and protection profiles and Appendix B contains additional details regarding the Information Assurance & Engineering Division (D87) formal inspection process.
DTIC
Computer Information Security; Data Processing; Data Processing Equipment

20000031599 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
Performance Metrics for Parallel Systems ***Final Report, 191996***
Pressel, D. M.; Jan. 2000; 33p; In English
Report No.(s): AD-A373437; ARL-TR-2145; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
One frequently needs to compare the performance of two or more parallel computers, but how should this be done? The most straightforward way to do this would be to rely upon a suite of benchmarks. Unfortunately, there are many problems and limitations with this approach. Therefore, one is frequently forced to rely upon a combination of approaches. Unfortunately, many of the alternative approaches are all too frequently based on excessively simplistic approximations and extrapolations. This report discusses some of these issues so that the problems they can cause may be avoided in the future.
DTIC
Parallel Computers; Parallel Processing (Computers); Performance Tests

20000031606 Department of the Navy, Washington, DC USA
Method and Apparatus for Automatic Generation of External Interface Specifications
Ackerman, John R., Inventor; Goff, Thomas F., Inventor; Jul. 13, 1999; 13p; In English; Supersedes US-Patent-Appl-SN-08806130
Patent Info.: Filed 3 Mar. 1997; US-Patent-Appl-SN-08,806,130; US-Patent-5,924,109
Report No.(s): AD-D019579; No Copyright; Avail: US Patent and Trademark Office, Microfiche
This patent discloses a method and apparatus for the automatic generation of interface specifications includes a communications network for enabling users of the apparatus to inter-communicate and to write files to pending, reference and interface data bases. The files written to the data bases are formatted and automatically received to reduce errors in the specification data in the files. A document generator responsive to commands accesses document template files in a document template data base to prepare defined documentation reflecting the external interlace specification from the files in the data bases.
DTIC
Data Bases; Architecture (Computers); Computer Networks; Patents

20000031624 Office of Naval Research, Arlington, VA USA
Conference Proceedings for the Thirteenth Annual IFIP Working Group 11.3 Conference on Database Security Held in Seattle, Washington, July 25 - 28, 1999
Jul. 28, 1999; 276p; In English
Report No.(s): AD-A373414; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche
This report contains the proceedings of the 13th Annual IFIP Working Group Conference on Database Security held at the Roosevelt Hotel in Seattle, Washington on 25-28 July 1999. Papers given at the conference are included. Some of the topics

discussed are information systems, and detection, computer cookies, electronic security, management systems, access control, multilevel security, computer hierarchies, security administration.
DTIC
Data Bases; Information Systems; Computer Information Security; Conferences

20000031742 Department of the Navy, Washington, DC USA
Operating Methods for a Universal Client Device Permitting a Computer to Receive and Display Information from Several Special Applications Simultaneously
Simonoff, Adam J., Inventor; Taft, Robert L., Inventor; McLintock, Brian T., Inventor; Fontenot, Larry A., Inventor; Aug. 31, 1999; 100p; In English; Supersedes US-Patent-Appl-SN-941544
Patent Info.: Filed 30 Sep. 1997; US-Patent-Appl-SN-08/941,544; US-Patent-5,944,784
Report No.(s): AD-D019528; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A Universal Client with a self-contained scripting language called GUIScript allows computing systems of varying architectures linked to the Internet or connected by an Intranet to run the same application software without modification or recompilation. Using a client server architecture, the Universal Client receives GUIScript from the server, which commands the Universal Client to display certain graphical user interface (GUI) objects. The GUIScript also describes the behavior of the GUI objects presented by the Universal Client, thus providing a personality which defines the client application without changing the Universal Client's software. The Universal Client can also send GUIScript to the server to cause the server to execute commands. A method of operating the computer system using the Universal Client and GUIScript is described.
DTIC
Patents; Client Server Systems; Applications Programs (Computers); Internets

20000031896 NASA Goddard Space Flight Center, Greenbelt, MD USA
Access to Space Interactive Design Web Site
Leon, John, NASA Goddard Space Flight Center, USA; Cutlip, William, NASA Goddard Space Flight Center, USA; Hametz, Mark, AI Solutions, Inc., USA; [2000]; 3p; In English; 45th; Small Payloads in Space, 30 Jul - 4 Aug. 2000, San Diego, CA, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The Access to Space (ATS) Group at NASA's Goddard Space Flight Center (GSFC) supports the science and technology community at GSFC by facilitating frequent and affordable opportunities for access to space. Through partnerships established with access mode suppliers, the ATS Group has developed an interactive Mission Design web site. The ATS web site provides both the information and the tools necessary to assist mission planners in selecting and planning their ride to space. This includes the evaluation of single payloads vs. ride-sharing opportunities to reduce the cost of access to space. Features of this site include the following: (1) Mission Database. Our mission database contains a listing of missions ranging from proposed missions to manifested. Missions can be entered by our user community through data input tools. Data is then accessed by users through various search engines: orbit parameters, ride-share opportunities, spacecraft parameters, other mission notes, launch vehicle, and contact information. (2) Launch Vehicle Toolboxes. The launch vehicle toolboxes provide the user a full range of information on vehicle classes and individual configurations. Topics include: general information, environments, performance, payload interface, available volume, and launch sites.
Author
Research and Development; Mission Planning; Payloads; Launching

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.

20000028277 Sunderland Univ., Centre for Adaptive Systems, Sunderland, UK
The Application of Adaptive Systems in Condition Monitoring
Adgar, Adam, Sunderland Univ., UK; Cox, Chris, Sunderland Univ., UK; Emmanouilidis, Christos, Sunderland Univ., UK; MacIntyre, John, Sunderland Univ., UK; Mattison, Peter, Sunderland Univ., UK; McGarry, Ken, Sunderland Univ., UK; Oatley, Giles, Sunderland Univ., UK; Smith, Peter, Sunderland Univ., UK; Taylor, Odin, Sunderland Univ., UK; International Journal of COMADEM; January 1998; Volume 1, No. 1, pp. 13-17; In English; See also 20000028275; Sponsored in part by Energy Efficiency Office; Copyright; Avail: Issuing Activity, Hardcopy

This paper provides an overview of four large collaborative projects, which are currently being undertaken by the Centre for Adaptive Systems at the University of Sunderland. The projects utilize adaptive system technology to solve condition monitoring problems, and are funded from a variety of sources including UK Government agencies and the European Union (EU). Each of the projects is very strongly problem and industry driven and aims to produce real results for the benefit of companies.
Author
Adaptive Control; Artificial Intelligence; Neural Nets; Detection; Finite Element Method; Conditions

20000028279 Brunel Univ., Centre for Neural Computing Applications, Egham, UK
Applying Neural Computing to Time Varying Signals
Harris, Tom, Brunel Univ., UK; Jiang, Hongwei, Brunel Univ., UK; International Journal of COMADEM; January 1998; Volume 1, No. 1, pp. 25-28; In English; See also 20000028275; Copyright; Avail: Issuing Activity, Hardcopy

This paper describes work carried out under the EPSRC, "Neural Computing - the Key Questions programme" and represents two years post doctorate study. Motor vehicle tires are required by law to be tested in various ways both during their design process and as part of their production quality control procedures. Dunlop goes a lot further than the law prescribes, carrying out a battery of tests and examinations, many of which are time consuming and labor intensive. One particular test is the high speed test which can take several hours but requires human operation. The objectives of this study were to examine the potential for neural computing to be applied to the high speed test operation. The data involved in monitoring the test were noisy, and varied throughout the test. Neural Computing methods have been developed to train and modify Kohonen neural networks in real time, during the test and provide an output suitable to control the test. These have been tested on-line in a simulator and off-line on real tire tests with good results.
Author
Motor Vehicles; Neural Nets; Tires; Acceptability; Genetic Algorithms; Machine Learning; Dynamic Tests

20000028393 SY Technology, Inc., Huntsville, AL USA
Medical Image and Information Processor ***Final Report, 20 Dec. 1995 - 1 Dec. 1999***
Banish, Michele, SY Technology, Inc., USA; Dec. 1999; 38p; In English
Contract(s)/Grant(s): F29601-96-C-0015; AF Proj. 3005
Report No.(s): AD-A373351; AFRL-DE-TR-1999-1032; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Pulse Coupled Neural Networks (PCNN) have been extended and modified to suit medical image segmentation applications. Previous research demonstrated the ability of a PCNN to ignore noisy variations in intensity and small spatial discontinuities in images that prove beneficial to image segmentation and image smoothing. This final report describes three research and development projects that relate to PCNN segmentation three different digital image processing applications and a CMOS integrated circuit implementation. The software for the diagnosis of Pulmonary Embolism from VQ lung scans uses PCNN in single burst mode for segmenting perfusion and ventilation images. The second project is attempting to detect cardiac infarct and ischemia by
DTIC
Image Processing; Computer Programs; Imaging Techniques; Diagnosis; Scanners

20000030661 CoGentex, Inc., Ithaca, NY USA
EMMA, An Evolution Memory Management Assistant ***Final Report, Jun. 1996 - Nov. 1999***
McCullough, Daryl, CoGentex, Inc., USA; Korelsky, Tanya, CoGentex, Inc., USA; Jan. 2000; 58p; In English
Contract(s)/Grant(s): F30602-96-C-0220; DARPA ORDER-D893; AF Proj. D893
Report No.(s): AD-A373403; AFRL-IF-RS-TR-1999-257; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

This report summarizes the research accomplished and the resulting software tool, Evolution Memory Management Assistant (EMMA), which was developed during the contract period. The goal of EMMA is to manage information used in software development throughout a system's life cycle. EMMA differs from current project management tools in that it manages not only the system requirements that developers must satisfy, but also the context in which the developers develop the system. This contextual information includes assumptions about the operating environment and user behavior, and it supports explicit planning of software evolution. EMMA also relates system development tasks to technical issues to help ensure that all members of the project are informed about the consequence of development decisions. EMMA keeps track of dependencies among system components and also the reasons (rationale) for dependencies. Thus, EMMA is flexible in considering contingencies and alternative approaches to building a system.
DTIC
Expert Systems; Computer Programs; Software Engineering

20000031338 Brown Univ., Dept. of Computer Science, Providence, RI USA

AI Approaches to Statistical Language Models ***Final Report, Mar. 1996-Aug. 1999***

Charniak, Eugene; Feb. 15, 2000; 5p; In English

Contract(s)/Grant(s): N00014-96-1-0549

Report No.(s): AD-A373537; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We have made a number of advances under this grant. We have created what is currently the most accurate parser for parsing into Penn-tree-bank-style trees; a program that identifies the antecedents of pronouns with 85% accuracy; a program that assigns function tags to parse text with 85% accuracy; a program that assigns referents to full noun phrases with 65% accuracy; very efficient parsers that explore very few constituents that do not appear in the final parse; and programs that discover semantic information about words from unlabeled text. Furthermore, all these programs work by statistical means.

DTIC

Artificial Intelligence; Parsing Algorithms; Natural Language (Computers); Natural Language Processing

20000031343 Army Research Inst. of Environmental Medicine, Natick, MA USA

Use of An Adaptive Neural Network to Simulate Physiological Control Systems: Feasibility Study Using Artificial Systems, ***1 Feb.-Oct. 1996, 1 Sep-Dec. 1999***

Doherty, T. J.; Feb. 2000; 22p; In English

Report No.(s): AD-A373572; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Attempts to identify physiological control systems using traditional engineering or statistical approaches generally fails to produce generalized models. This report presents an alternative approach using a hybrid model. An artificial neural network is used to model the control system and a lumped parameter model is used to model the passive system. Two artificial (model) water bath systems and two robot arm models were developed to test the feasibility of this approach. ”Observed” data were generated using these model systems by recording responses to simulated perturbations. The hybrid model was then fit to the observed data by adjusting neural network connection weights to minimize the error between observed and predicted values for one or more system variables. The fitting procedure was repeated three times under each set of conditions. Only 2-3 hidden layer nodes were required to simulate the artificial model systems. It was not necessary to include the control system output in the error term. The methodology was robust; successful control system identification was performed when errors (+/- 10% variance) were introduced into the observed data set and also when errors (+/- 10% variance) were introduced into the passive system parameter values.

DTIC

Neural Nets; Artificial Intelligence; Physiology; Adaptive Control; Network Control; Computer Networks; Computerized Simulation

20000031351 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne Australia

Incorporating Intelligent Computer Generated Forces in a Human-in-the-Loop Simulation, Phase 1, Establishment of a Research Testbed

Clark, Peter; Pongracic, Helen; Cross, Martin; Morton, Jim; Fulton, John; Oct. 1999; 47p; In English

Report No.(s): AD-A372692; DSTO-TR-0889-Phase 1; DODA-AR-011-122-Phase-1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Air Operations Division (AOD) of the Defence Science and Technology Organization (DSTO) has developed a range of simulation tools whose capabilities include air combat modelling. The Air operations Simulation Centre (AOSC) provides a facility for Human-in-the-Loop (HiL) simulation, and the BattleModel provides intelligent Computer Generated Forces (CGFs). The AOSC and the BattleModel have been integrated to create a research testbed for air combat simulation as Phase One of a Technology Demonstrator. This has been the first integration of operationally credible CGFs with a HiL facility in an air environment by DSTO. The CGFs have been implemented using dMARSTM agent controlled fighter aircraft. Interaction with the AOSC has been achieved using Distributed Interactive Simulation (DIS). This paper outlines the rationale for using intelligent CGFs and HiLs in the same synthetic environment, details the development of the research testbed, describes the initial results achieved and makes suggestions for the way forward.

DTIC

Computerized Simulation; Combat; Technologies; Artificial Intelligence; Research and Development; Aerial Photography

20000031384 Department of the Navy, Washington, DC USA

Object Extraction in Images

Kamgar-Parsl, Behrooz, Inventor; Jul. 13, 1999; 9p; In English; Supersedes US-Patent-Appl-SN-08652044

Patent Info.: Filed 23 May 1996; US-Patent-5,923,776; US-Patent-Appl-SN-08,652,044

Report No.(s): AD-D019588; No Copyright; Avail: US Patent and Trademark Office, Microfiche

This patent discloses a method and apparatus for extracting an object from an image, in which one locates a pixel within the image (the ”central” pixel), and then sequentially compares the brightness of neighboring pixels, proceeding outward from the central pixel. In so doing, one determines the largest dropoffs in brightness between neighboring pixels, and uses these to determine a brightness threshold for extracting pixels belonging to the object. In a preferred embodiment, one determines the threshold by comparing the largest dropoffs, identities overlapping regions of brightness level common to all the dropoffs, and sets the threshold at the midpoint of the common overlapping region.

DTIC

Patents; Extraction; Images; Imaging Techniques; Pixels

20000031637 Stottler Henke Associates, Inc., Belmont, CA USA

Artificial Intelligence Techniques for Pilot Approach Decision Aid Logic (PADAL) System ***Final Report, Phase II***

Richards, Rob; Jan. 28, 2000; 67p; In English

Contract(s)/Grant(s): N68335-96-C-0250

Report No.(s): AD-A372871; 195; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

In this project the objective was to improve Landing Signal Officer (LSO) decision making by using Artificial Intelligence (Al) and other techniques to develop pilot trending and ship oscillation decision support aids. During the pursuit and satisfaction of the primary objective, several sub-objectives were met. The project developed pilot trending and ship oscillation recognition techniques and software by investigating the use of Fourier, wavelet, neural networks, fuzzy logic and other transform techniques in conjunction with the application of decision-centered design methodologies from cognitive psychology; the research determined that a combination of neural networks and fuzzy logic applied under a decision-centered design approach proved most useful and was developed. We determined the significant aircraft approach parameters and similarity measures and important pilot considerations and similarity measures. We also developed pilot trending techniques and software using case-based reasoning and combinations of other Al techniques. In addition, in conjunction with many LSOs, we determined the best display options and most appropriate display logic for the information produced by the pilot trending and oscillation recognition modules, and designed and implemented the resulting LSO interface. Then the design concepts were implemented and tested, in an iterative fashion. The decision aid prototypes were evaluated and critiqued by active LSOs with enhancements based on feedback from the LSOs.

DTIC

Artificial Intelligence; Knowledge Based Systems; Wavelet Analysis; Decision Support Systems; Neural Nets

20000031648 Defense Advanced Research Projects Agency, Arlington, VA USA

Advances in Enterprise Control. AEC Proceedings, November 15-16, 1999/San Diego, California ***Final Report***

Nov. 16, 1999; 299p; In English

Report No.(s): AD-A373117; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

This document contains copies of 33 papers prepared for and presented at the November 1999 DARPA JFACC Symposium on Advances in Enterprise Control. The purpose of the Symposium was to bring together researchers and practitioners from industry, government and academia to present and discuss the latest developments in all aspects of enterprise control. The Symposium presented papers that (a) describe the results of original research on the topics of interest, (b) provide broad reviews of the state-of-the-art, and (c) propose and advocate new research directions. Also presented were papers that describe significant practical experiences with current enterprise control systems: complex dynamic phenomena, non-obvious successes and failures, requirements and unmet needs. The modern enterprise is a large-scale dynamic system with broadly distributed and potentially conflicting goals, resources and constraints, with multiple semi-autonomous participants of both human and artificial nature (e.g., large military operations, financial/trading institutions, logistics systems, manufacturing plants, power grids). The increasing capabilities of technology to collect, automatically generate, and disseminate information offer the possibility for large-scale enterprises to be more responsive to change. Enterprise plans and orders quickly become obsolete as new information about the current situation becomes available. The challenge is to use real-time information to re-direct enterprise operations effectively. Such systems and challenges define the scope of the Symposium.

DTIC

Human Factors Engineering; Artificial Intelligence; Game Theory

20000031733 Pennsylvania State Univ., Applied Research Lab., University Park, PA USA
Investigation of Multi-Dimensional Interpolation Methodologies for Vehicle Maneuvering and Design ***Final Report***
Garga, Amulya K.; Gibeling, Howard J.; Davoudzadah, Farhad; Jan. 24, 2000; 10p; In English
Contract(s)/Grant(s): N00014-96-1-0966
Report No.(s): AD-A372704; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Recurrent and feedforward neural networks were studied and compared for their ability to adequately capture dynamics from a physics based computational model of submarine maneuvering dynamics. The comparison was done using one trajectory of a rise maneuver. Very good approximation was achieved and recurrent neural networks. The results with modular feedforward networks were not as good, but were reasonable. When the networks were tested for an unseen dive maneuver, the response followed the shape of the desired response but there were large overshoots. This preliminary study demonstrated that it is possible to learn dynamics from computational models, that recurrent neural networks are much better suited for this task, and that additional data are required for good generalization. However, an approach for very limited training data set design was developed for further investigation. The applications of this approach are numerous, including online use of detailed models, rapid iterative design update, improved control of a submarine and eventually its noise characteristics, condition based maintenance in the presence of aging and degrading parts, and potentially, damage assessment and mitigation in hostile situations.
DTIC
Computerized Simulation; Submarines; Mathematical Models

64
NUMERICAL ANALYSIS

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

20000028387 Hampton Univ., VA USA
Recursive Condition for Positivity of the Angle for Multivariate Stationary Sequences
Makagon, A., Hampton Univ., USA; Miamee, A. G., Hampton Univ., USA; Schroder, S. W., Hampton Univ., USA; Proceedings of the American Mathematical Society; 1998; ISSN 0002-9939; Volume 126, No. 6, pp. 1821-1825; In English
Contract(s)/Grant(s): N00014-89-J-1824; DAAH04-96-I-0027; N00014-95-I-0660
Report No.(s): AD-A369974; Copyright; Avail: Issuing Activity, Microfiche, Hardcopy

In this note a recursive type condition for positivity of the angle between past and future for q-variate stationary sequences is provided. In the can q = 2 it gives a simple different proof of a result due to, Solev and Tserkhtsvadze on basicity of bivariate stationary sequences.
Author
Proving; Sequencing; Predictions; Recursive Functions

20000028388 Eastern Virginia Medical School, Center for Pediatric Research, . Norfolk, VA USA
Analysis of Serially Correlated Data Using Quasi-Least Squares
Shults, Justine, Eastern Virginia Medical School, USA; Chaganty, N. Rao, Old Dominion Univ., USA; Biometrics; December 1998; Volume 54, pp. 1622-1630; In English
Contract(s)/Grant(s): DAAH04-96-I-0070
Report No.(s): AD-A369985; ARO-32886.5-MA; Copyright; Avail: Issuing Activity, Microfiche, Hardcopy

Quasi-least squares (QLS), a marginal statistical approach via generalized estimating equations that is described in the balanced data setting by Chaganty, allows for application of a wide range of working correlation structures when analyzing serially correlated data, We extend the application of QLS to serially correlated, unequally spaced, and unbalanced data using three useful working correlation models. the first-order autoregressive (AR(l)), the Markov, and the generalized Markov structure described by Nunez-Anton and Woodworth. We compare QLS and the original formulation of the generalized estimating equation approach (GEE) for these structures, demon6trating that (i) infeasibility of the GEE correlation parameter estimates can be a problem, (ii) it is difficult to obtain consistent moment estimates of the correlation parameters for the generalized Markov structure, and (iii) the use of QLS can lead to reduced mean square error of the estimate of the regression-parameter for small samples of moderately correlated data. to choose between alternative correlation models, we propose a criterion that in based on the principle of generalized least squares. Finally, data for which the generalized Markov structure is appropriate are analyzed to demonstrate the use of QLS in selecting a suitable working correlation structure and identifying important covariates.
Author
Estimating; Least Squares Method; Correlation; Markov Processes

20000029576 Institute for Computer Applications in Science and Engineering, Hampton, VA USA

Active Shielding and Control of Environmental Noise ***Final Report***

Loncaric, J., Institute for Computer Applications in Science and Engineering, USA; Ryabenkii, V. S., Institute for Computer Applications in Science and Engineering, USA; Tsynkov, S. V., Institute for Computer Applications in Science and Engineering, USA; February 2000; 36p; In English

Contract(s)/Grant(s): NAS1-97046; RTOP 505-90-52-01

Report No.(s): NASA/CR-2000-209862; NAS 1.26:209862; ICASE-2000-9; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present a mathematical framework for the active control of time-harmonic acoustic disturbances, Our approach provides for the exact volumetric cancellation of unwanted noise in a given predetermined region of space while leaving the rest of the total acoustic field unaffected. For eliminating the unwanted component, one needs to know neither the actual noise sources nor properties of the supporting medium. The controls are built based solely on the measurements performed oil the perimeter of the region to be shielded; moreover, the controls themselves are concentrated also only near this perimeter. The measured quantities can refer to the total acoustic field, and the methodology automatically distinguishes between its adverse and friendly components. We construct a closed form general solution to the aforementioned noise control problem. The apparatus used for deriving this general solution is closely connected to the concepts of generalized potentials and boundary projections of Calderon's type. For a given total wave field, the application of the Calderon's projection allows us to decompose it into the incoming and outgoing components with respect to a particular domain of interest, which may have arbitrary shape. Then, the controls are designed so that to suppress the incoming component for the domain to be shielded or alternatively, the outgoing component for the domain, which is complementary to the one to be shielded. To demonstrate that the new noise control technique is appropriate, we analyze a simple two-dimensional model example that allows full analytical consideration.

Author

Shielding; Active Control; Noise Reduction

20000030701 Rice Univ., Dept. of Mathematics, Houston, TX USA

Besicovitch's Circle Pairs, Analytic Capacity, and Cauchy Integrals for a Class of Unrectifiable 1-Sets

Farag, Hany M., Rice Univ., USA; Annales Academia Scientiarum Fennica, Mathematica; 2000; ISSN 1239-629X; Volume 25, pp. 179-186; In English; Copyright; Avail: Issuing Activity

We give an elementary proof of a theorem, which is originally due to Mattila on the vanishing of the analytic capacity of a certain natural subclass of the totally unrectifiable 1-sets in the plane, which includes self-similar sets (which are not line segments). We also give a version in R(sup n), in relation to the Cauchy kernel. Our main tool is the circle pair idea which goes back to Besicovitch who used it in his study of the density properties of rectifiable, and totally unrectifiable 1-sets in the plane. Our method is also self-contained to some extent.

Author

Circles (Geometry); Analytic Functions; Cauchy Problem; Integrals

20000030705 Canterbury Univ., Dept. of Mathematics, Christchurch, New Zealand

A Decomposition Theorem for Solutions of Parabolic Equations

Watson, N. A., Canterbury Univ., New Zealand; Annales Academia Scientiarum Fennicea, Mathematica; 2000; ISSN 1239-629X; Volume 25, pp. 151-160; In English; Copyright; Avail: Issuing Activity

Let L be a second order linear parabolic partial differential operator, with smooth and bounded coefficients defined on X = R(sup n) x (0, a). Let E be an open subset of X, and let K be a compact subset of E. If u is a solution of L(sub u) = 0 on E\K, we prove that there is a unique decomposition u = upsilon + Omega, where L(upsilon) = 0 on E(sub omega) = 0 on X\K, and omega is zero both at infinity and on R(sup n) x (0, k), where k = inf{t : K logical product (R(sup n) x {f} does not equal 0}. A more detailed decomposition is given for the case where K reflex subset contains R(sup n) x {d}.

Author

Decomposition; Theorems; Parabolic Differential Equations

20000030709 Hong Kong Univ. of Science and Technology, Dept. of Mathematics, Kowloon, Hong Kong

On the Growth and Factorization of Entire Solutions of Algebraic Differential Equations

Liao, Liang-Wen, Hong Kong Univ. of Science and Technology, Hong Kong; Yang, Chung-Chun, Hong Kong Univ. of Science and Technology, Hong Kong; Annales Academia Scientiarum Fennicea, Mathematica; 2000; ISSN 1239-629X; Volume 25, pp. 73-84; In English; Sponsored in part by UGC, Hong Kong

Contract(s)/Grant(s): HKUST Proj. 712/96p; Copyright; Avail: Issuing Activity

In this paper we discuss the growth and factorization of entire solutions of some classes of first-order algebraic differential equations and prove that any entire solution of a first-order algebraic differential equation must be pseudo-prime.
Author
Factorization; Differential Equations

20000030710 Potsdam Univ., Institut fuer Mathematik, Potsdam, Germany
Operator Representations of Definitizable Functions
Jonas, Peter, Potsdam Univ., Germany; Annales Academia Scientiarum Fennicea, Mathematica; 2000; ISSN 1239-629X; Volume 25, pp. 41-72; In English; Copyright; Avail: Issuing Activity

Let L(H) denote the algebra of all bounded linear operators on a separable Hilbert space H. An L(H)-valued holomorphic function F in the complement of the unit circle T satisfying F(bar-z)(sup -1) = -F(z)* such that the values of F in the unit disc have nonnegative real part is called a Caratheodory operator function. A definitizable operator function is a function with the same T-antisymmetry which can be transformed into a Caratheodory function by multiplying with a rational scalar function and by adding a rational operator function. We prove here, relying heavily on a result of T. Ya. Azizov, that the definitizable functions are precisely those operator functions which can be represented in the form F(z) = iS + Gamma(sup +)(U + z)(U - z)(sup -)Gamma, where S is a bounded selfadjoint operator in H, U is a definitizable unitary operator in some Krein space K, Gamma is a bounded operator of H in K, and Gamma(sup +) denotes the Krein space adjoint of Gamma. If the representing operator U for a given definitizable function fullfills some minimality condition, then the restrictions of U to all Pontryagin type spectral subspaces are uniquely determined up to unitary equivalence. The main objective of this paper are the connections between sign properties of F, which were introduced, and similar properties of the representing operators U. The results are carried over to a similar class of operator functions meromorphic in C \ R.
Author
Antisymmetry; Hilbert Space; Linear Operators; Rational Functions; Analysis (Mathematics)

66
SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

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

20000027708 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
FIDO - Video File
Apr. 27, 1999; In English; Videotape: 10 min. playing time, in color, with sound
Report No.(s): AVC-1999-062; NONP-NASA-VT-2000033900; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS

Field Integrated Design and Operations (FIDO) rover is a prototype of the Mars Sample Return rovers that will carry the integrated Athena Science Payload to Mars in 2003 and 2005. The purpose of FIDO is to simulate, using Mars analog settings, the complex surface operations that will be necessary to find, characterize, obtain, cache, and return samples to the ascent vehicles on the landers. This videotape shows tests of the FIDO in the Mojave Desert. These tests include drilling through rock and movement of the rover. Also included in this tape are interviews with Dr Raymond Arvidson, the test director for FIDO, and Dr. Eric Baumgartner, Robotics Engineer at the Jet Propulsion Laboratory.
CASI
Mars Sample Return Missions; Prototypes; Roving Vehicles; Robotics; Research Vehicles; Mars (Planet); Mars Exploration; Mars Surface

20000031716 Department of the Navy, Washington, DC USA
System and Apparatus for the Detection of Randomness in Time Series Distributions Made Up of Sparse Data Sets
O'Brien, Francis J., Jr., Inventor; Nguyen, Chung T., Inventor; Bates, Bruce J., Inventor; Aug. 20, 1999; 33p; In English
Patent Info.: Filed 20 Aug. 1999; US-Patent-Appl-SN-09/379,210
Report No.(s): AD-D019523; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

A method and apparatus are provided for automatically characterizing the spatial arrangement among the data points of a time series distribution in a data processing system wherein the classification of said time series distribution is required. The method and apparatus utilize a grid in Cartesian coordinates to determine (1) the number of cells in the grid containing at least one input data point of the time series distribution; (2) the expected number of cells which would contain at least one data point in a random distribution in said grid; and (3) an upper and lower probability of false alarm above and below said expected value utilizing a

discrete binomial probability relationship in order to analyze the randomness characteristic of the input time series distribution. A labeling device also is provided to label the time series distribution as either random or nonrandom, and/or random or nonrandom within what probability, prior to its output from the invention system for further I output from the invention of the remainder of the data processing system for further analysis.
DTIC
Signal Processing; Patent Applications; Time Series Analysis

67
THEORETICAL MATHEMATICS

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

20000028365 Rutherford Appleton Lab., Chilton, UK
Numerical Analysis Group ***Progress Report, Jan. 1998 - Dec. 1999***
Duff, Iain S., Editor, Rutherford Appleton Lab., UK; Feb. 15, 2000; ISSN 1358-6254; 70p; In English
Report No.(s): RAL-TR-2000-001; Copyright; Avail: Issuing Activity

We discuss the research activities of the Numerical Analysis Group in the Computational Science and Engineering Department at the Rutherford Appleton Laboratory of CLRC for the period January 1998 to December 1999.
Author
Numerical Analysis; Linear Systems; Matrix Methods; Matrices (Mathematics); Linear Equations

20000030681 Geneva Univ., Section de Mathematiques, Geneva, Switzerland
Involutions and Simple Closed Geodesics on Riemann Surfaces
Schaller, Paul Schmutz, Geneva Univ., Switzerland; Annales Academia Scientiarum Fennica, Mathematica; 2000; ISSN 1239-629X; Volume 25, pp. 91-100; In English; Copyright; Avail: Issuing Activity

A new geometric characterization of Riemann surfaces with an orientation pre-serving involution is given. It is proved that a closed Riemann surface M of genus g greater than or equal to 2 has an involution with exactly k = 2g + 2 - 4j fixed points, 0 less than or equal to j less than or equal to 1/2g, if and only if M has a set F of 2g simple closed geodesics which all intersect in the same two points A and B (such that among the elements of F there are no further intersection points). Moreover, A and B are fixed points of the involution and F partitions M into 2g hyperbolic quadrilaterals such that exactly k - 2 of them are symmetric (opposite sides of a symmetric quadrilateral are contained in the same element of F).
Author
Riemann Manifold; Geodesic Lines; Geometry

20000030700 Pontificia Univ. Catolica de Chile, Facultad de Matematicas, Santiago, Chile
Hencky-Prandtl Nets and Constant Principal Strain Mappings with Isolated Singularities
Gevirtz, Julian, Pontificia Univ. Catolica de Chile, Chile; Annales Academia Scientiarum Fennica, Mathematica; 2000; ISSN 1239-629X; Volume 25, pp. 187-238; In English; Copyright; Avail: Issuing Activity

The work presented in this paper is motivated in large measure by the appearance of Hencky-Prandtl nets (HP-nets) in the context of planar quasi-isometries with constant principal stretching factors (cps-mappings) and by compelling analogies between such mappings and those given by analytic functions of one complex variable. We study the behavior of HP-nets in the vicinity of isolated singularities and use the results of this analysis to show that if an HP-net is regular in the entire plane except for isolated singularities, then it can have at most two of them, and that all possible nets of this kind fall into five classes each of which depends on a small number of parameters. In light of the relationship between HP-nets and cps-mappings it follows that an analogous statement holds for the latter as well, and this connection is further exploited to prove that HP-nets regular except for isolated singularities in smoothly bounded Jordan domains have nontangential limits in the appropriate sense at almost all boundary points. The treatment includes, in addition, an interpretation of cps-mappings with isolated singularities as deformations produced by the cryptocrystalline solidification with microscopic flaws of a planar film and a discussion of the problem of just how the singularities of such mappings can actually be distributed in a given domain.
Author
Singularity (Mathematics); Structured Grids (Mathematics); Complex Variables; Analytic Functions

20000030702 Universidad Nacional de Educacion a Distancia, Facultad de Ciencias, Madrid, Spain

Period Matrices of Accola-Maclachlan and Kulkarni Surfaces

Bujalance, E., Universidad Nacional de Educacion a Distancia, Spain; Costa, A. F., Universidad Nacional de Educacion a Distancia, Spain; Gamboa, J. M., Universidad Complutense, Spain; Riera, G., Universidad Catolica de Chile, Chile; Annales Academia Scientiarum Fennica, Mathematica; 1999; ISSN 1239-629X; Volume 25, pp. 161-177; In English

Contract(s)/Grant(s): DGICYT-PB-95-0017; CEE CHRX-CT-93-0408; DGICYT-PB-95-0354; CEE CHRX-CT-93-0408; FONDECYT-8970007; Copyright; Avail: Issuing Activity

We compute the period matrices of the Riemann surfaces given by the equations omega(exp 2) = z(sup 2g + 2) - 1 (Accola-Maclachlan surfaces) and omega(sup 2g + 2) = z(z - 1)(sup g-1)(z + 1)(sup g+2) (Kulkarni surfaces). Furthermore, we obtain the triples of matrices associated to the rea@forms for these Riemann surfaces.

Author

Riemann Manifold; Matrices (Mathematics)

20000030706 Wesleyan Univ., Dept. of Mathematics, Middletown, CT USA

Jorgensen's Inequality for Discrete Convergence Groups

Bonfert-Taylor, Petra, Michigan Univ., USA; Annales Academia Scientiarum Fennicea, Mathematica; 2000; ISSN 1239-629X; Volume 25, pp. 131-150; In English; Copyright; Avail: Issuing Activity

We explore in this paper whether certain fundamental properties of the action of Kleinian groups on the Riemann sphere extend to the action of discrete convergence groups on bar-R(sup 2). A Jorgensen inequality for discrete K-quasiconformal groups is developed, and it is shown that such an inequality depends naturally on the quasiconformal dilatation K. Furthermore, it is established that no such inequality can hold for general discrete convergence groups. In the discontinuous case a universal constraint on discreteness is formulated for both quasiconformal and general convergence groups.

Author

Riemann Manifold; Inequalities; Discrete Functions

20000030707 Academy of Sciences of the Ukraine, Inst. for Applied Mathematics and Mechanics, Donetsk, Ukraine

Infinitesimal Geometry of Quasiregular Mappings

Gutlyanskii, V. Ya., Academy of Sciences of the Ukraine, Ukraine; Martio, O., Helsinki Univ. of Technology, Finland; Ryazanov, V. I., Academy of Sciences of the Ukraine, Ukraine; Vuorinen, M., Helsinki Univ. of Technology, Finland; Annales Academia Scientiarum Fennicea, Mathematica; 2000; ISSN 1239-629X; Volume 25, pp. 101-130; In English

Contract(s)/Grant(s): RFFI-95-01-00345a; Copyright; Avail: Issuing Activity

We introduce the notion of the infinitesimal space for a quasiregular mapping at a point. This can be used to study local topological and geometric properties of the mapping also at those points where the mapping is not differentiable.

Author

Geometry; Functions (Mathematics)

20000030708 Geneva Univ., Section de Mathematiques, Geneva, Switzerland

Geometric Characterization of Hyperelliptic Reimann Surfaces

Schaller, Paul Schmutz, Geneva Univ., Switzerland; Annales Academia Scientiarum Fennicea, Mathematica; 2000; ISSN 1239-629X; Volume 25, pp. 85-90; In English; Copyright; Avail: Issuing Activity

A new geometric characterization of hyperelliptic Riemann surfaces is given. It is proved that a closed Riemann surface of genus g greater than or equal to 2 is hyperelliptic if and only if M has a set of at least 2g - 2 simple closed geodesics which all intersect in the same point (and mutually intersect in no other point).

Author

Geometry; Ellipticity; Riemann Manifold

20000030711 Lille-1 Univ., UFR de Mathematiques Pures et Appliquees, Villeneuve-d'Asoq, France

Behavior of Quasiregular Semigroups near Attracting Fixed Points

Mayer, Volker, Lille-1 Univ., France; Annales Academia Scientiarum Fennicea, Mathematica; 2000; ISSN 1239-629X; Volume 25, pp. 31-39; In English; Copyright; Avail: Issuing Activity

We study the dynamical behavior of quasiconformal groups and of quasiregular semigroups near attracting fixed points. In the homeomorphic case we show that there is a 1- parameter quasiconformal loxodromic group of (bar-R)(sup n), n greater than or equal to 3, that cannot be quasiconformally linearized. This implies that Martin's result, which says that the cyclic quasiconformal loxodromic groups are all quasiconformal conjugates of (x approaches 2x), cannot be quantitative. In the

non-injective situation we exhibit an example of a quasiregular semigroup whose elements have a common attracting fixed point and which cannot be quasiconformally linearized at this point. For the dynamics of uniformly quasiregular mappings at superattracting fixed points, we show that there are several distinct quasiconformal conjugacy classes by classifying the power mappings of [My2].
Author
Group Theory; Conjugates

20000030712 Helsinki Univ. of Technology, Inst. of Mathematics, Helsinki, Finland
Growth of Operator Valued Meromorphic Functions
Nevanlinna, Olavi, Helsinki Univ. of Technology, Finland; Annales Academia Scientiarum Fennicea, Mathematica; 2000; ISSN 1239-629X; Volume 25, pp. 3-30; In English; Copyright; Avail: Issuing Activity

We discuss two characteristic functions, T(sub infinity) and T(sub 1), to measure the growth of operator valued meromorphic functions. The smaller one, T(sub infinity), is based on the operator norm, while T(sub 1) works within finitely trace class meromorphic functions and is preserved in inversion. Applications to perturbation analysis of linear operators are given.
Author
Meromorphic Functions; Linear Operators; Mathematical Logic; Analysis (Mathematics)

20000030734 Nakai (Mitsuru), Chita, Japan
Existence of Quasi-Isometric Mappings and Royden Compactifications
Nakai, Mitsuru, Nakai (Mitsuru), Japan; Annales Academia Scientiarum Fennica, Mathematica; 2000; ISSN 1239-629X; Volume 25, pp. 239-260; In English
Contract(s)/Grant(s): MOESC-09640180; MOESC-09640230; MOESC-10640190; MOESC-11640187; Copyright; Avail: Issuing Activity

It is shown that Royden rho-compactifications for 1 less than p is less than rho less than d of two orientable and countable Riemannian manifolds of the same dimension d greater than or equal to 2 are homeomorphic if and only if there exists a homeomorphism between these two Riemannian manifolds which is quasi-isometric outside some of their compact subsets.
Author
Riemann Manifold; Fixed Points (Mathematics); Compacting

20000031631 NASA Glenn Research Center, Cleveland, OH USA
Initialized Fractional Calculus
Lorenzo, Carl F., NASA Glenn Research Center, USA; Hartley, Tom T., Akron Univ., USA; February 2000; 18p; In English
Contract(s)/Grant(s): RTOP 519-30-53
Report No.(s): NASA/TP-2000-209943; NAS 1.60:209943; E-12101; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper demonstrates the need for a nonconstant initialization for the fractional calculus and establishes a basic definition set for the initialized fractional differintegral. This definition set allows the formalization of an initialized fractional calculus. Two basis calculi are considered; the Riemann-Liouville and the Grunwald fractional calculi. Two forms of initialization, terminal and side are developed.
Author
Calculus; Differential Equations; Laplace Transformation; Linear Operators

20000031639 Naval Postgraduate School, Monterey, CA USA
Sensitivity Analysis of the Topology of Classification Trees
Kobayashi, Izumi; Dec. 1999; 78p; In English
Report No.(s): AD-A372965; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The use of classification trees is one of the most widely used techniques in classification. It is well known that classification trees are not stable in their topology, in contrast to their robustness with respect to misclassification rate. This thesis defines a measure that compares the topology of two trees and studies how a tree's topology changes when the dependent (y) variable or the independent (x) variables are perturbed. This allows us to examine the "robustness" of tree topology under perturbation and to compare it to the robustness with respect to the misclassification rate under the same perturbations. We show that the tree topology can change significantly even for small perturbations in many sets of data. This suggests that even small measurement errors in the variables can affect the tree topology greatly. Because data are often measured with error, it follows that splitting rules in trees may not be suitable for use in making policy decisions. We propose a measure for tree topology, and show that tree topology

changes faster than the misclassification rate does under mild perturbations. This finding formalizes the concept that tree models are more stable in terms of misclassification rate than in terms of topology.
DTIC
Topology; Robustness (Mathematics); Independent Variables; Dependent Variables; Perturbation

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ACOUSTICS

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

20000028392 Space and Naval Warfare Systems Command, San Diego, CA USA
Multimode Acoustic Source ***Final Report***
Booth, Newell O.; Sullivan, Shelby F., Sr.; Dec. 1999; 60p; In English
Report No.(s): AD-A373198; SPAWAR/CA-TR-1812; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A deployed impulsive acoustic source can be programmed remotely (as from an aircraft) to ping in different modes at selectable depths, each mode having a different combination of spectra and beampatterns. The choice of modes is achieved by controlling the timing and firing order of explosive elements positioned in the array. Mode frequencies, beamwidths, and associated bandwidths are determined at the time of the array's manufacture by the number of elements and the spacing. Each of the modes has different beam and spectral characteristics which are useful in different environments and in different tactical situations. The acoustic characteristics of the source in each of the modes are described, and acoustic design criteria are derived. Application examples are illustrated.
DTIC
Sound Generators; Design Analysis

20000029596 Research Inst. of National Defence, Div. of Systems and Underwater Technology, Stockholm, Sweden
High Resolution Methods in Active Sonar Array Signal Processing
Bohlin, P.; Jan. 1999; 80p; In English
Report No.(s): PB2000-103094; FOA-R-99-01066-313-SE; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy

In this report, the problem of high resolution array signal processing in an underwater scenario is discussed. With such method high resolution in bearing can obtained even for an array with a restricted length and they are therefore of great value for torpedo target seekers. The methods may by a beam space transform also be applicable to older torpedo target seekers. Some different models for distributed sources are discussed as possible models of reverberation. A number of methods to estimate the parameters of this kind of sources are evaluated by numerical simulations. The following methods are compared: DSPE, DISPARE, WSF, MUSIC, DML, Spread-MODE and WLS. The result was that all these methods were very sensible to modeling errors. Point source methods are also discussed and beam space transforms are introduced to reduce the computational cost. The report is a Master of Science Thesis at Chalmers University of Technology.
NTIS
Sonar; Signal Processing; Error Analysis; Sound Transmission; Arrays

20000030658 NASA Kennedy Space Center, Cocoa Beach, FL USA
Ultrasonic Imaging System
Youngquist, Robert C., Inventor, NASA Kennedy Space Center, USA; Moerk, Steven, Inventor, NASA Kennedy Space Center, USA; Nov. 09, 1999; 10p; In English
Patent Info.: Filed 28 Apr. 1997; NASA-Case-KSC-11909; US-Patent-5,979,239; US-Patent-Appl-SN-845900; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

An imaging system is described which can be used to either passively search for sources of ultrasonics or as an active phase imaging system. which can image fires. gas leaks, or air temperature gradients. This system uses an array of ultrasonic receivers coupled to an ultrasound collector or lens to provide an electronic image of the ultrasound intensity in a selected angular region of space. A system is described which includes a video camera to provide a visual reference to a region being examined for ultrasonic signals.
Official Gazette of the U.S. Patent and Trademark Office
Ultrasonics; Imaging Techniques; Search Radar

20000030676 NASA Langley Research Center, Hampton, VA USA

F-16XL and F-18 High Speed Acoustic Flight Test Databases

Kelly, J. J., Lockheed Martin Engineering and Sciences Co., USA; Wilson, M. R., Lockheed Martin Engineering and Sciences Co., USA; Rawls, J., Jr., Lockheed Martin Engineering and Sciences Co., USA; Norum, T. D., NASA Langley Research Center, USA; Golub, R. A., NASA Langley Research Center, USA; December 1999; 274p; In English

Contract(s)/Grant(s): RTOP 537-09-21-21

Report No.(s): NASA/TM-1999-209529; NAS 1.15:209529; L-17899; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

This report presents the recorded acoustic data and the computed narrow-band and 1/3-octave band spectra produced by F-18 and F-16XL aircraft in subsonic flight over an acoustic array. Both broadband-shock noise and turbulent mixing noise are observed in the spectra. Radar and c-band tracking systems provided the aircraft position which enabled directivity and smear angles from the aircraft to each microphone to be computed. These angles are based on source emission time and thus give some idea about the directivity of the radiated sound field due to jet noise. A follow-on static test was also conducted where acoustic and engine data were obtained. The acoustic data described in the report has application to community noise analysis, noise source characterization and validation of prediction models. A detailed description of the signal processing procedures is provided. Follow-on static tests of each aircraft were also conducted for which engine data and far-field acoustic data are presented.

Author

Flight Tests; F-16 Aircraft; F-18 Aircraft; Data Bases; Data Acquisition; Subsonic Speed; Spectral Bands; Sound Fields; Octaves; Jet Aircraft Noise; Acoustic Properties

20000031344 Washington Univ., Applied Physics Lab., Seattle, WA USA

High-Frequency Bistatic Scattering Model for Elastic Seafloors

Jackson, Darrell R.; Feb. 2000; 45p; In English

Contract(s)/Grant(s): N00014-98-1-0119

Report No.(s): AD-A373575; APL-UW-TM-2-00; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A model for bistatic acoustic scattering at high frequencies (10-100 kHz) from elastic seafloors is developed by combining the elastic small-slope roughness scattering model of Yang and Broschat with the elastic volume scattering model of Ivakin. The combined model is applicable to a variety of seafloors, including clays, silts, sands, gravel, and rock. Although elastic effects are negligible in sands and finer sediments, they are essential in treating reflection and scattering by rock, which cannot be usefully represented by a fluid model. Use of the small-slope approximation makes it possible to avoid the cumber-some interpolation between the Kirchhoff and perturbation approximations employed in the previous APL-UW backscattering model and allows larger levels of roughness than are permitted with conventional scattering approximations. The model results agree with those of the APL-UW backscattering model and with those of the APL-UW bistatic model for clays, silts, and sands. The inclusion of elastic effects attributes the high levels of scattering observed for cobble and rock seafloors to a combination of roughness and volume scattering, and replaces the empirical treatment of cobble and rock seafloors previously used in the APL-UW backscattering model by a physical one. For these cases, the new model sometimes produces unphysical results for scattering near the specular direction, indicating the need for further work on this problem.

DTIC

Acoustic Scattering; Ocean Bottom; Backscattering; Elastic Scattering; Mathematical Models

20000031348 Woods Hole Oceanographic Inst., MA USA

Ray Solutions to Sound Scattering by Complex Bodies: Application to Zooplankton

Stanton, Timothy K.; Chu, Dezhang; Wiebe, Peter H.; Feb. 14, 2000; 15p; In English

Contract(s)/Grant(s): N00014-89-J-1729; N00014-95-1-0817

Report No.(s): AD-A373754; WHOI-9204; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Acoustic surveys of zooplankton in the freshwater and marine environments result in echograms displaying spatial patterns of volume scattering strength and sometimes target strength data. A crucial element to the interpretation of the data is understanding the acoustic scattering properties of the individual animals. Because of the complexity of the boundary conditions of the animals, approximate scattering models have been developed. In this paper, laboratory backscattering data from various types of zooplankton are presented and compared with some of the models. Much of the modeling has involved the use of ray formulations- a subject that was significantly advanced by Uberall.

DTIC

Fresh Water; Acoustic Scattering; Zooplankton; Backscattering

20000031362 NASA Langley Research Center, Hampton, VA USA

Modelling Aerodynamically Generated Sound: Recent Advances in Rotor Noise Prediction

Brentner, Kenneth S., NASA Langley Research Center, USA; 2000; 12p; 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 2000-0345; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

A great deal of progress has been made in the modeling of aerodynamically generated sound for rotors over the past decade. The Ffowcs Williams-Hawkings (FW-H) equation has been the foundation for much of the development. Both subsonic and supersonic quadrupole noise formulations have been developed for the prediction of high-speed impulsive noise. In an effort to eliminate the need to compute the quadrupole contribution, the FW-H has also been utilized on permeable surfaces surrounding all physical noise sources. Comparison of the Kirchhoff formulation for moving surfaces with the FW-H equation have shown that the Kirchhoff formulation for moving surfaces can give erroneous results for aeroacoustic problems.

Author

Aerodynamic Noise; Rotor Aerodynamics; Aeroacoustics; Noise Prediction (Aircraft); Aircraft Noise

20000031385 Department of the Navy, Washington, DC USA

Frequency-Steered Acoustic Beam Forming System and Process

Thompson, R. L., Inventor; Zehner, W. J., Inventor; Jul. 13, 1999; 7p; In English

Patent Info.: Filed 5 Feb. 97,; US-Patent-Appl-SN-08,807,106; US-Patent-5,923,617

Report No.(s): AD-D019589; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A sonar system includes a pulse generator that produces an electrical signal having a plurality of frequencies. An acoustic radiator formed as a first blazed acoustic array is arranged lobe driven by the electrical signal from the pulse generator. The blazed acoustic array includes a plurality of acoustic elements rotated away from the general plane of the array. The acoustic elements are arranged to be driven by the electrical signal from the pulse generator so that they radiate a sonic field that includes a plurality of sonic frequencies with each frequency being radiated at a characteristic angle. An acoustic receiver formed as a second blazed acoustic array is arranged such that components of the acoustic field reflected from the target toward the acoustic receiver produce acoustic waves having frequencies that correspond to the angles of incidence of the reflected acoustic field components. The signals indicative of the reflected frequencies are processed to form an image of the target. The invention may be embodied including phase delay, time delay, or synthetic aperture beamforming means.

DTIC

Acoustic Emission; Acoustic Measurement; Acoustic Frequencies; Beam Steering; Beams (Radiation); Beamforming

20000031675 Department of the Navy, Washington, DC USA

Dual-Section Push-Pull Underwater Projector

Piquette, Jean C., Inventor; Sep. 07, 1999; 6p; In English; Supersedes US-Patent-Appl-SN-09226627

Patent Info.: Filed 21 Dec. 1998; US-Patent-5,949,741; US-Patent-Appl-SN-09,226,627

Report No.(s): AD-D019550; No Copyright; Avail: US Patent and Trademark Office, Microfiche

The present invention relates to an underwater acoustic projector comprising a housing formed from a rigid material, a fixed plate secured to the housing, a first annular electrostrictive ring and a second annular electrostrictive ring positioned on one side of the fixed plate, and a third annular electrostrictive ring and a fourth annular electrostrictive ring positioned on a second side of the fixed plate. The first and second annular rings are separated by a first moving plate, while the third and fourth annular rings are separated by a second moving plate. The annular rings are formed from lead magnesium niobate or lead magnesium niobate-lead titanate and are wired for dual push-pull operation for reducing the non-linearity of the response of the annular rings.

DTIC

Patents; Underwater Acoustics; Electrostriction; Sound Generators

20000031706 Department of the Navy, Washington, DC USA

Acoustic Vector Sensing Sonar System

Cray, Benjamin A., Inventor; Jul. 27, 1999; 8p; In English; Supersedes US-Patent-Appl-SN-09013465, AD-D018868.

Patent Info.: Filed 27 Jan. 1998; US-Patent-5,930,201; US-Patent-Appl-SN-09,013,465

Report No.(s): AD-D019540; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A system for the detection of acoustic signals utilizing an array of acoustic sensors coupled to a beam former which generates a steered acoustic beam using the output from one or more of the acoustic sensors within the array. The acoustic sensors include a multiaxis vector sensor co-located with a scalar acoustic pressure sensor. The beam former generates a weighted output for each acoustic sensor by combining the weighted output of the scalar pressure sensor with the scalar field generated by forming the inner

product of the vector components measured at each sensor location with a vector component weighting vector. The weighted output signals are delayed to synchronize the phase of the weighted output signal to that of a weighted signal at a reference array location. The resulting delayed weighted output signals are then summed.
DTIC
Patents; Acoustic Emission; Detection; Signal Detectors; Sonar

20000031712 Department of the Navy, Washington, DC USA
Image Conversion for a Scanning Toroidal Volume Search Sonar
McDonald, Robert J., Inventor; Wilbur, Jo Ellen, Inventor; Manning, Robert C., Inventor; Tubridy, Lisa B., Inventor; Aug. 31, 1999; 8p; In English; Supersedes US-Patent-Appl-SN-138053
Patent Info.: Filed 17 Aug. 1998; US-Patent-Appl-SN-09/138,053; US-Patent-5,946,272
Report No.(s): AD-D019519; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A method is provided to compress and display received data from a toroidal volume search sonar (TVSS) in terms of horizontal range. For any TVSS receive beam having a horizontal component projection that is equal to or greater than a selected horizontal range, the data values occurring at that selected horizontal range are averaged to form a compressed data value. Range dependent weight factors are applied during the averaging process so that the effects of surface and bottom reverberation do not bias the compressed data value. The compressed data value can then be displayed as a function of horizontal range for a series of sonar pings in order to provide a time history.
DTIC
Image Converters; Patents; Weight (Mass)

20000031741 Department of the Navy, Washington, DC USA
Fiber Optic Hydrophone Array
Sansone, Louis E., Inventor; Jul. 27, 1999; 8p; In English; Supersedes US-Patent-Appl-SN-137867
Patent Info.: Filed 10 Aug. 1998; US-Patent-Appl-SN-137,867; US-Patent-5,930,203
Report No.(s): AD-D019527; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A fiber optic hydrophone array is provided in which a plurality of tubes, e.g., fiber optic hydrophones, are to be secured about an elongate elastomeric member having a diameter that hinders each tube from being slid thereover. Each time a tube is to be positioned and secured, longitudinal tension is applied to the elongate elastomeric member to form a reduced cross section along its length in order to facilitate the sliding of each tube therealong. Adhesive is applied about the elongate elastomeric member at a desired position along its length while longitudinal tension is being applied. Then, one tube is slid along the length of reduced cross section to the desired position. The longitudinal tension in the elongate elastomeric member is then relaxed. The reduced cross section expands radially outward thereby forming a void free layer of adhesive between the tube and the elongate elastomeric member.
DTIC
Fiber Optics; Hydrophones; Patents; Adhesives

20000031774 Research Inst. of National Defence, Div. of Systems and Underwater Technology, Stockholm, Sweden
Interactive Analysis and Visualization Tool for Hydroacoustical Applications ***Ett interaktivt analys - och visualiseringsverktyg foer hydroakustiska tillaempningar***
Lindstroem, H.; Jul. 1999; ISSN 1104-9154; 32p; In English; Original contains color illustrations
Report No.(s): PB2000-103069; FOA-R-99-01186-409-SE; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

A Graphical User Interface (GUI) has been designed and implemented for an underwater acoustic signal processing package developed at FOA. The GUI is used for filtering and analysis of measured data from e.g. hydroacoustic sensors and is constructed to simplify the choice of data sets, processing algorithms, control parameter values and visualizations of the results. by an object-oriented approach, future inclusion of new algorithms is simplified. A new visualization method concerning two dimensional array results is proposed. The design of the GUI is simple, consistent and easy to apply, and the use of the GUI is demonstrated using experimental data.
NTIS
Underwater Acoustics; Signal Processing

72
ATOMIC AND MOLECULAR PHYSICS

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

20000029491 Johns Hopkins Univ., Applied Physics Lab., Laurel, MD USA

In-Situ Spectrometry of Neutrons

Maurer, Richard H., Johns Hopkins Univ., USA; National Space Biomedical Research Institute; Sep. 30, 1999, pp. B-114 - B-115; In English; See also 20000029456; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

High energy charged particles of extra-galactic, galactic and solar origin collide with spacecraft structures in Earth orbit outside the atmosphere and in interplanetary travel beyond the Earth's magnetosphere. These primaries create a number of secondary particles inside the structures that can produce a significant ionizing radiation environment. This radiation is a threat to long term inhabitants or travelers for space missions and produces an increased risk of cancer and DNA damage. The primary high energy cosmic rays and trapped protons collide with common spacecraft materials such as aluminum and silicon and create secondary particles inside structures that are mostly protons and neutrons. Charged protons are readily detected and instruments are already in existence for this task. Neutrons are electrically neutral and therefore much more difficult to measure and detect. These neutrons are reported to contribute 30-60% of the dose inside space structures and cannot be ignored. Currently there is no compact, portable and real time neutron detector instrumentation available for use inside spacecraft or on planetary surfaces where astronauts will live and work. We propose to design and build a portable, low power and robust neutron spectrometer that will measure the neutron spectrum from 10 KeV to 500 MeV with at least 10% energy resolution in the various energy intervals. This instrument will monitor the existing neutron environment both inside spacecraft structures and on planetary surfaces to determine the safest living areas, warn of high fluxes associated with solar storms and assist the NSBRI Radiation Effects Team in making an accurate assessment of increased cancer risk and DNA damage to astronauts. The instrument uses a highly efficient proportional counter Helium 3 tube at the lowest energy intervals where .equivalent damage factors for tissue are the highest (10 KeV-2 MeV). The Helium 3 tube may be shielded with a cadmium absorber to eliminate the much less damaging, but more prevalent, thermal and epithermal neutrons and to make the structure of the spectrum more accurate in the 20 KeV-2 MeV range; or a pair of tubes, one shielded and one unshielded, can be combined so that the difference in their counts yields the thermal neutron contribution. The spectrometer also uses a 5mm lithium drifted bulk silicon solid state detector in the medium energy range of 2-20 Mev and two standard silicon surface barrier detectors separated by tens of millimeters behind a I cm thick polyethylene moderator in a stack or telescope arrangement for the high energy neutrons (>20 MeV). In the medium and high energy regions equivalent damage factors are lower but hits from one or a small number of neutrons may prove to be important. The silicon detector systems for medium and high energy neutrons will discriminate against charged particles by using a plastic cesium iodide scintillator of an appropriate geometry monitored by a silicon PIN photodiode.

Author

Neutron Spectrometers; Neutrons; Proportional Counters; Radiation Effects; Scintillation Counters; Neutron Emission

20000030704 Rutherford Appleton Lab., Chilton UK

Neutron Compton Scattering by Proton and Deuteron Systems with Entangled Spatial and Spin Degrees of Freedom

Lovesey, S. W.; Karlsson, E. B.; Dec. 16, 1999; ISSN 1358-6254; 24p; In English

Report No.(s): PB2000-103163; RAL-TR-1999-081; Copyright; Avail: National Technical Information Service (NTIS)

Several recent experiments on liquid and solid samples containing protons or deuterons have shown an interesting anomaly, which is apparently absent when the hydrogen isotopes are replaced by heavier particles. The anomaly is a shortfall in the intensity of energetic neutrons scattered by the samples; specifically, the intensity per hydrogen isotope in bulk samples is smaller than the intensity for total scattering by an isolated hydrogen isotope. Short-lived correlations in the spatial and spin degrees of freedom of the hydrogen isotopes have been proposed as an explanation of the anomaly. The correlations involve entanglements of the degrees of freedom created by the requirements of quantum mechanics applied to identical particles. by using energetic neutrons to perform Compton scattering experiments on the hydrogen isotopes the time-scale of the experimental probe covers the region of 10 to the minus 16th power - 10 to the minus 15th power s where entangled states might still be expected to survive.

NTIS

Neutron Scattering; Compton Effect; Electron Scattering; Spin

20000031872 National Inst. for Fusion Science, Toki, Japan

Recovery of Cesium in the Hydrogen Negative Ion Sources

Belchenko, Yu. I., Academy of Sciences (USSR), USSR; Oka, Y., National Inst. for Fusion Science, Japan; Kaneko, O., National Inst. for Fusion Science, Japan; Takeiri, Y., National Inst. for Fusion Science, Japan; Krivenko, A., Academy of Sciences (USSR), USSR; Osakabe, M., National Inst. for Fusion Science, Japan; Tsumori, K., National Inst. for Fusion Science, Japan; Asano, E., National Inst. for Fusion Science, Japan; Kawamoto, T., National Inst. for Fusion Science, Japan; Akiyama, R., National Inst. for Fusion Science, Japan; December 1999; ISSN 0915-633X; 12p; In English

Report No.(s): NIFS-621; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Cesium recovery from the polluted layers in the 1/3 scale hydrogen negative ion source LHD-NBI system has tested. It was found, that the cesium recovery can be produced by additional discharges as from the cesium layer, aged by tungsten and residual gas, so as from the cesium layers, polluted by an occasional water leak. The highest cesium recovery to NI production was produced by a xenon arc, while glow discharge and arcing in hydrogen were less effective. The mechanism of recovery is the ejection of cesium from the underlying enriched layer by the arc and its transport to the surface.

Author

Cesium; Recovery; Hydrogen Ions; Ion Sources; Pollution

73
NUCLEAR PHYSICS

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

20000031395 NASA Langley Research Center, Hampton, VA USA

Fragmentation of 200 and 244 MEV/u Carbon Beams in Thick Tissue-Like Absorbers

Golovchenko, A. N., Joint Inst. for Nuclear Research, USSR; Skvarc, J., Stefan (J.) Inst., Slovenia; Ilic, R., Stefan (J.) Inst., Slovenia; Sihver, L., Royal Inst. of Tech., Sweden; Bamblevski, V. P., Joint Inst. for Nuclear Research, USSR; Tretyakova, S. P., Joint Inst. for Nuclear Research, USSR; Schardt, D., Gesellschaft fuer Schwerionenforschung m.b.H., Germany; Tripathi, R. K., Hampton Univ., USA; Wilson, J. W., NASA Langley Research Center, USA; Bimbot, R., Paris XI Univ., France; Nuclear Instruments and Methods in Physics Research B: Beam Interations with Materials and Atoms; 1999; ISSN 0168-583X; Volume 159, Section B, pp. 233-240; In English; Copyright; Avail: Issuing Activity

Stacks consisting of thin CR-39 sheets sandwiched between thick lucite and water absorbers were perpendicularly bombarded by C-12 ions at 200 and 244 MeV/u. Track radius distributions representing the charge composition of the fragmented beams were automatically measured by a particle track analysis system. After analysis of the nuclear charge distributions, the total charge removal cross-sections and elemental production cross-sections of fragments with atomic numbers from 5 to 3, were obtained down to the lower energies (approx. 50 and 100 MeV/u, respectively). It has been found that the measured total charge removal cross-section agrees with theoretical predictions within approx. 10% and very well with previous experiments in corresponding energy regions. Two model calculations for production of B fragment are in good agreement with our measured data while a third model overestimates it by approx. 12%. Theoretical cross-sections for Be and Li fragments differ strongly among the different models and from measured values.

Author

Carbon 12; Absorbers (Materials); Fragmentation; Beams (Radiation)

74
OPTICS

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

20000027675 Lockheed Martin Missiles and Space, Palo Alto, CA USA

Solar-B Focal Plane Instrument Package, Phase A ***Final Report, 1 Feb. - 31 Oct. 1999***

November 1999; 142p; In English

Report No.(s): LMMS-2B00027; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The document is the final report for the FPP for solar-B. It summarizes the state for the plans for the science investigation and the instrument development, The Focal Plane Package (FPP) phase A study was conducted from 1 February, 1999 to 31

October, 1999. During this period, the FPP design was developed to a level that is internally consistent and matches the interfaces as currently defined by ISAS. to reach this point, there were 4 technical reviews with our Japanese partners and their contractors. Three of these meetings were held in Japan and one was held at LMATC in Palo Alto. These meetings generated a number of action items from each side. The resolution of these action items has been the major influence on the evolution of the FPP design.
Derived from text
Focal Plane Devices; Fabrication; Research

20000030655 NASA Ames Research Center, Moffett Field, CA USA
Photonic Switching Devices Using Light Bullets
Goorjian, Peter M., Inventor, NASA Ames Research Center, USA; Oct. 05, 1999; 20p; In English; Continuation-in-part of US-Patent-Appl-SN-528621, filed 25 Aug. 1995
Patent Info.: Filed 25 Apr. 1997; NASA-Case-ARC-14057-3; US-Patent-5,963,683; US-Patent-Appl-SN-845733; US-Patent-Appl-SN-528621; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A unique ultra-fast, all-optical switching device or switch is made with readily available, relatively inexpensive, highly nonlinear optical materials. which includes highly nonlinear optical glasses, semiconductor crystals and/or multiple quantum well semiconductor materials. At the specified wavelengths. these optical materials have a sufficiently negative group velocity dispersion and high nonlinear index of refraction to support stable light bullets. The light bullets counter-propagate through, and interact within the waveguide to selectively change each others' directions of propagation into predetermined channels. In one embodiment, the switch utilizes a rectangularly planar slab waveguide. and further includes two central channels and a plurality of lateral channels for guiding the light bullets into and out of the waveguide. An advantage of the present all-optical switching device lies in its practical use of light bullets, thus preventing the degeneration of the pulses due to dispersion and diffraction at the front and back of the pulses. Another advantage of the switching device is the relative insensitivity of the collision process to the time difference in which the counter-propagating pulses enter the waveguide. since. contrary to conventional co-propagating spatial solitons, the relative phase of the colliding pulses does not affect the interaction of these pulses. Yet another feature of the present all-optical switching device is the selection of the light pulse parameters which enables the generation of light bullets in nonlinear optical materials. including highly nonlinear optical glasses and semiconductor materials such as semiconductor crystals and/or multiple quantum well semiconductor materials.

Official Gazette of the U.S. Patent and Trademark Office
Diffraction; Optical Switching; Quantum Wells; Semiconductors (Materials); Sensitivity; Waveguides

20000030667 Washington State Univ., Pullman, WA USA
Radiative Processes and Dephasing in Semiconductors ***Final Report, 1 Feb. - 30 Nov. 1998***
Citrin, David S., Washington State Univ., USA; Jan. 18, 2000; 3p; In English
Contract(s)/Grant(s): F49620-98-1-0215
Report No.(s): AD-A373454; 2464-0297; AFRL-SR-BL-TR-00-0028; No Copyright; Avail: CASI; A01, Microfiche; A01, Hardcopy

A workshop was held in Coeur d'Alene, idaho, 2-4 February 1998 as an Optical Society of America Topical Meeting. The research areas covered by the workshop roughly fell under the heading of ultrafast and coherent nonlinear optical properties of semiconductors; nevertheless, a number of speakers from other fields presented papers at the conference in order to stimulate cross-disciplinary discussion. Approximately thirty papers were presented, and a proceedings was published by the Optical Society of America as a volume in their Trends in Optics and Photonics series. AFOSR funds supported the travel and local expenses of eight invited speakers.

DTIC
Semiconductors (Materials); Conferences; Optical Properties

20000030675 NASA Lewis Research Center, Cleveland, OH USA
Selection of Optical Glasses Using Buchdahl's Chromatic Coordinate
Griffin, DeVon W., NASA Lewis Research Center, USA; [1999]; 4p; In English; International Journal Design Conference, 1998, USA
Contract(s)/Grant(s): RTOP 101-53; No Copyright; Avail: Issuing Activity, Hardcopy

This investigation attempted to extend the method of reducing the size of glass catalogs to a global glass selection technique with the hope of guiding glass catalog offerings. Buchdahl's development of optical aberration coefficients included a transformation of the variable in the dispersion equation from wavelength to a chromatic coordinate omega defined as omega = (lambda - lambda(sub 0))/ 1 + 2.5(lambda - lambda(sub 0)) where lambda is the wavelength at which the wavelength is calculated

and lambda(sub 0) is a base wavelength about which the expansion is performed. The advantage of this approach is that the dispersion equation may be written in terms of a simple power series and permits direct calculation of dispersion coefficients. While several promising examples were given, a systematic application of the technique to an entire glass catalog and analysis of the subsequent predictions was not performed. The goal of this work was to apply the technique in a systematic fashion to glasses in the Schoft catalog and assess the quality of the predictions.
Derived from text
Optical Materials; Glass

20000030731 Washington State Univ., Dept. of Physics, Pullman, WA USA
High-Speed All-Optical Switching ***Final Report, 1 Nov. 1997 - 31 Dec. 1998***
Citrin, David S., Washington State Univ., USA; Jan. 18, 2000; 19p; In English
Contract(s)/Grant(s): F49620-97-1-0535
Report No.(s): AD-A373458; Rept-2447-0020; AFRL-SR-BL-TR-00-0029; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

A scheme for ultrahigh-speed all-optical switching based on semiconductor heterostructures was explored theoretically. The approach was anticipated to be applicable to systems operating in the 10 to 100 gigabit/sec regime. Our role was to simulate the carrier dynamics in semiconductor heterostructures under ultrafast (picosecond and subpicosecond) laser excitation. Pulse characteristics were found to coherently populate and depopulate the semiconductor heterostructure of carriers on the picosecond timescale.
DTIC
Optical Switching; Fiber Optics

20000031360 West Virginia Univ., Dept. of Physics, Morgantown, WV USA
Development of Nonlinear Optical Materials for Optical Parametric Oscillator and Frequency Conversion Applications in the Near- and Mid-Infrared ***Final Report, 1 Sep. 1996 - 31 Aug. 1999***
Halliburton, Larry E.; Giles, Nancy C.; Myers, Thomas H.; Aug. 31, 1999; 72p; In English
Contract(s)/Grant(s): F49620-96-1-0452
Report No.(s): AD-A373243; AFRL-SR-BL-TR-00-0020; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Point defects and their associated optical absorption bands often limit the performance of tunable laser sources (i.e., optical parametric oscillators) operating in the near and mid-infrared. Near-edge absorption in ZnGeP2 crystals and gray tracks in KTP crystals are examples of device limiting phenomena in commercially available materials, and both of these effects result from uncontrolled point defects introduced into the crystals during growth. This project identified and characterized the dominant defects in these materials. The experimental techniques employed were electron paramagnetic resonance (EPR), electron-nuclear double resonance (ENDOR) photoluminescence (PL), optical absorption, and Hall measurements. Information obtained from these studies is published and has been provided to our industrial partners where crystal growth procedures were modified in order to minimize the particular defects being identified in our spectroscopic studies. Our industrial partners were Sanders (a Lockheed Martin Company) in Nashua, NH. and Crystal Associates, Inc. in East Hanover, NJ. Specific studies included: platinum-, silicon-, and titanium-associated traps in KTP; the zinc vacancy and cation-antisite defects in ZnGeP2; and Hall measurements of CdGeAs2.
DTIC
Optical Materials; Oscillators; Frequency Converters

20000031383 Department of the Navy, Washington, DC USA
System and Method for Recovering a Signal of Interest from a Phase Modulated Signal Using Quadrature Sampling
Assard, Gerald L., Inventor; Deuss, Antonio L., III, Inventor; Blakely, Barry A., Inventor; Jul. 13, 1999; 10p; In English; Supersedes US-Patent-Appl-SN-08967740, AD-D018866.
Patent Info.: Filed 10 Nov. 1997; US-Patent-5,923,030; US-Patent-Appl-SN-08,967,740
Report No.(s): AD-D019587; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A digital receiver system is used to recover a signal of interest, such as a measurand signal, from a phase modulated signal detected from a system utilizing quadrature carriers, such as a fiber optic interferometer sensor system. The digital receiver system includes a quadrature sampling demodulator that sampling the phase modulated signal by using quadrature sampling periods to recover the odd and even components of the signal of interest. The digital receiver system can be used with an interferometer sensor system having an array of sensors that multiplex the measurand signals, e.g., using time or wavelength division

multiplexing. Sampling with quadrature time samples provides a spacing in time between the samples that allows additional sensors to be multiplexed.
DTIC
Digital Systems; Receivers; Signal Processing; Fiber Optics; Phase Modulation; Phase Demodulators

20000031617 NASA Langley Research Center, Hampton, VA USA
Multi-Gas Sensor
Sachse, Glenn W., Inventor, NASA Langley Research Center, USA; Wang, Liang-Guo, Inventor, NASA Langley Research Center, USA; LeBel, Peter J., Inventor, NASA Langley Research Center, USA; Steele, Tommy C., Inventor, NASA Langley Research Center, USA; Rana, Mauro, Inventor, NASA Langley Research Center, USA; Dec. 28, 1999; 20p; In English; Provisional application US-Patent-Appl-SN-067917, filed 8 Dec. 1997 and provisional application US-Patent-Appl-SN-073822, filed 5 Feb. 1998
Patent Info.: Filed 5 Feb. 1998; NASA-Case-LAR-15361-1; US-Patent-6,008,928; US-Patent-Appl-SN-019473; US-Patent-Appl-SN-067917; US-Patent-Appl-SN-073822; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A multi-gas sensor is provided which modulates a polarized light beam over a broadband of wavelengths between two alternating orthogonal polarization components. The two orthogonal polarization components of the polarization modulated beam are directed along two distinct optical paths. At least one optical path contains one or more spectral discrimination element, with each spectral discrimination element having spectral absorption features of one or more gases of interest being measured. The two optical paths then intersect, and one orthogonal component of the intersected components is transmitted and the other orthogonal component is reflected. The combined polarization modulated beam is partitioned into one or more smaller spectral regions of interest where one or more gases of interest has an absorption band. The difference in intensity between the two orthogonal polarization components is then determined in each partitioned spectral region of interest as an indication of the spectral emission/absorption of the light beam by the gases of interest in the measurement path. The spectral emission/absorption is indicative of the concentration of the one or more gases of interest in the measurement path. More specifically, one embodiment of the present invention is a gas filter correlation radiometer which comprises a polarizer, a polarization modulator, a polarization beam splitter, a beam combiner, wavelength partitioning element, and detection element. The gases of interest are measured simultaneously and, further, can be measured independently or non-independently. Furthermore, optical or electronic element are provided to balance optical intensities between the two optical paths.
Author
Gas Detectors; Inventions; Patents; Light Beams; Light Emission; Spectral Bands; Spectral Emission

20000031629 Nebraska Univ., Dept. of Mechanical Engineering, Lincoln, NE USA
Electromagnetic Interaction, Thermal and Mass Transfer Modeling of the Photothermal Modulation of Mie Scattering Spectroscopy of Aerosols ***Final Report, 17 May-30 Sep 1999***
Barton, John P.; Jan. 15, 2000; 25p; In English
Contract(s)/Grant(s): N00173-99-1-G009
Report No.(s): AD-A373431; LWF/11-188-13101; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Theoretical procedures were developed, computer programs were written, and demonstration calculations were performed investigating the modeling and predicted performance of the photothermal modulation of Mie scattering (PMMS) spectroscopy method for aerosol diagnostics.
DTIC
Aerosols; Mie Scattering; Computer Programs; Mass Transfer; Mathematical Models; Diagnosis

20000031682 California Univ., Los Angeles, CA USA
Recirculating Photonic Filter (RPF): A Wavelength Selective True Time Delay for Optically Controlled Phased Array Sensors ***Final Report, Nov. 1996-Aug. 1998***
Jalali, Bahram; Jan. 2000; 24p; In English
Contract(s)/Grant(s): F30602-97-C-0019; AF Proj. E391
Report No.(s): AD-A373427; AFRL-SN-RS-TR-1999-261; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report describes our theoretical investigation into the nature of the experimentally observed loss and crosstalk in the RPF. The study shows that the loss of the RPF can be reduced to around 2dB through optimum design of the diffraction grating and waveguide. Phase linearity and measurements and temperature sensitivity of the RPF are also presented. We then describe optically controlled two dimensional beam steering systems wherein the signal is transferred between the delay states all optically be employing wavelength conversion in a semiconductor optical amplifier (SOA). We describe the concept and demonstrate

experimentally this scheme to achieve independent control of azimuth and elevation beam steering. Applications of this technique include the ability to extend the total number of discrete time delays. In any wavelength selective time delay technique the spectral tuning range of the tunable laser source limits the number of different delays that can be obtained. However, by cascading two N channel time delay stages with wavelength conversion, we now obtain N2 different delays. Another application is the ability to realize digitally controlled time delays. An m stage cascade, with m independently tuned lasers, can be used to realize the most significant bit (MSB) while the successive time delay stages will represent the less significant bits.
DTIC
Photonics; Phased Arrays; Optical Filters; Light Amplifiers; Tunable Lasers

20000031711 Department of the Navy, Washington, DC USA
Optical Filters Based on Uniform Arrays of Metallic Waveguides
Rosenberg, Armand, Inventor; Tonucci, Ronald J., Inventor; Nov. 08, 1999; 22p; In English
Patent Info.: Filed 8 Nov. 1999; US-Patent-Appl-SN-09,435,832
Report No.(s): AD-D019517; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

The present invention relates to spectral filters and methods of making spectral filters for filtering infrared, visible and ultraviolet radiation. More particularly, the present invention relates to high-pass, low-pass and band-pass filters constructed by coating the channels of a nanochannel glass array with a reflective material.
DTIC
Patent Applications; Optical Filters; Infrared Radiation; Bandpass Filters

20000031715 Department of the Navy, Washington, DC USA
Underwater Spectroscopic Detector
Andrews, John M., Inventor; Martini, Leonard J., Inventor; Lieberman, Stephen H., Inventor; Smith, Leon V., Inventor; Anderson, Gregory W., Inventor; Jul. 27, 1999; 14p; In English; Supersedes US-Patent-Appl-SN-08/868114
Patent Info.: Filed 3 Jun. 1997; US-Patent-Appl-SN-868,114; US-Patent-5,929,453
Report No.(s): AD-D019522; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A spectroscopic detector suitable for detecting oil spills in an aquatic environment includes a buoyant container having an optical window; an optical energy generator mounted in the container for directing an optical energy beam through the window; an optical detector for generating an output signal in response to detecting a second optical energy beam received in the container through the window; and a beam splitter for directing the second optical energy beam to the optical detector, The generation of the optical energy beam and operation of the optical detector may be time gated to reduce thermal noise and isolate the sampled optical energy from background light. The optical energy beam preferably has UV components which inhibits the formation of biological organisms on the optical window.
DTIC
Spectroscopy; Patents; Background Radiation

20000031973 National Defence Research Establishment, Div. of Sensor Technology, Linkoeping, Sweden
Preparation and Characterisation of NLO Materials for Optical Limiting ***Syntes och Karaktaerisering av NLO Material foer Optisk Begraensning***
Lopes, C., National Defence Research Establishment, Sweden; Eriksson, A., National Defence Research Establishment, Sweden; Lindgren, M., National Defence Research Establishment, Sweden; Svensson, S., National Defence Research Establishment, Sweden; Jul. 1999; 34p; In English
Report No.(s): PB2000-101494; FOA-R-99-01215-612-SE; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

A series of novel materials for optical limiting have been synthesized and characterized using the z-scan technique. Cumulenes are shown to have promising optically non-linear behavior for optical limiting devices. Modification of these molecules can potentially give high two-photon absorption cross-section that enable strong optical limiting properties in the transparent regime 400-900 nm. Platinum (II) acetylides are found to be transparent in the visible and also show optically non-linear absorption in this wave-length range. The preparation of several organo-metallic cluster molecules with extensive pi-conjugation network was successful. The latter materials were shown to generally have good optical transparency in the visible. Further non-linear optical characterization is in progress. The materials are being synthesized and optimized in close collaboration with University partners within the laser protection sub-project of the 'photonics in defense applications program'. Preliminary time-resolved measurements have been made in collaboration with PRL-SUNY (USA). An investigation of how to perform

standardized tests and evaluations of optical limiting materials and devices has started within the established collaboration with DSTO.
NTIS
Nonlinear Optics; Optical Properties; Light (Visible Radiation); Lasers

20000032016 Communications Research Lab., Tokyo, Japan
Optical Technology Development in CRL: New Eyes to Observe Space and Terrestrial
Itabe, Toshukazu, Communications Research Lab., Japan; Review of the Communications Research Laboratory; Dec. 1993; ISSN 0914-9279; Volume 39, No. 4, pp. 275-285; In Japanese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Optics' long history dates from the mythological age. Geometrical optics principles have been clear since the 17th century. People devised telescopes and many optical instruments according to the laws of geometrical optics. Modern physics, from the end of the 19th century, brought innovations the optics and lead to the developments of modern optical instruments. of three key optical technologies, two were developed in this century. These technologies are: 1. the telescope and optical fiber as instruments for optical transmission and reception. 2. optoelectric devices as a detector. 3. the laser as a source of light. We, humans, have invented new "eyes" to see space and the earth using these key technologies in recent years. CRL has been doing various kinds of research to develop these new eyes since early on, when CRL was called RRL. Here, we will review past, present and future research projects related to optical technology in CRL.
Author
Optical Communication; Infrared Astronomy; Optical Radar

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PLASMA PHYSICS

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

20000028362 National Inst. for Fusion Science, Toki, Japan
Complexity in Laser Plasma Instabilities
Skoric, Milos M., Vinca Inst. of Nuclear Sciences, Yugoslavia; Sato, Tetsuya, National Inst. for Fusion Science, Japan; Maluckov, Aleksandra, Graduate Inst. for Advanced Studies, Japan; Javanovic, Moma S., Nis Univ., Yugoslavia; December 1999; ISSN 0915-633X; 26p; In English; 24th; 24th International Conference: Phenomena in Ionized Gases (ICPIG), 16-20 Jul. 1999, Warsaw, Poland
Report No.(s): NIFS-618; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

High intensity laser interaction with a plasma exhibits a rich variety of strongly nonlinear plasma phenomena. In an underdense plasma, stimulated Raman scattering (SRS) and stimulated Brillouin scattering (SBS) are two laser parametric instabilities of a greatest relevance. We show examples of isolated nonlinear SRS and SBS and discuss some of the experimental SRS anomalies that largely depart from the standard theory. As an example of a complex interplay between nonlinear SRS and SBS we show results of their anti-correlated behavior. Based on a concept of self-organization we put forward a simple model of SRS capable of reproducing basic experimentally observed anomalous features. Finally, we close with an example of fascinating new physics observed in SRS induced by an ultra-short pulse relativistic-intensity laser.
Author
Laser Plasmas; Magnetohydrodynamic Stability; Nonlinearity; Laser Plasma Interactions

20000028363 National Inst. for Fusion Science, Toki, Japan
Optimization of Cs Deposition in the 1/3 Scale Hydrogen Negative Ion Source for LHD-NBI System
Oka, Y., National Inst. for Fusion Science, Japan; Takeiri, Y., National Inst. for Fusion Science, Japan; Belchenko, Yu. I., Academy of Sciences (USSR), USSR; Hamabe, M., Chubu Univ., Japan; Kaneko, O., National Inst. for Fusion Science, Japan; Tsumori, K., National Inst. for Fusion Science, Japan; Osakabe, M., National Inst. for Fusion Science, Japan; Asano, E., National Inst. for Fusion Science, Japan; Kawamoto, T., National Inst. for Fusion Science, Japan; Akiyama, R., National Inst. for Fusion Science, Japan; December 1999; ISSN 0915-633X; 16p; In English
Report No.(s): NIFS-620; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A compact cesium deposition system was used for direct deposition of cesium atoms and ions onto the inner surface of the 1/3 scale Hydrogen Negative Ion Source for the LHD-NBI system. A small, well defined amount of cesium deposition in the range of 3-200 mg was tested. Negative ion extraction and acceleration were carried out both in the pure hydrogen operation mode and

in the cesium mode. Single Cs deposition of 3-30 mg to the plasma chamber have produced temporary 2-5 times increases of H- yield, but the yield was decreased within several discharge pulses to the previous steady-state value. Two consecutive 30 mg depositions done within a 3-5 hours/ 60 shot interval, produced a similar temporary increase of H- beam, but reached a larger H- yield steady-state value. Deposition of larger 0.1-0.2 g Cs portions with a 20-120 hours/ 150-270 shot interval improved the H- yield for a long (2-5 days) period of operation. Directed depositions of Cs to the various walls of the plasma chamber showed approximately the same H- increase. Deposition of 0.13 g Cs to a surface polluted by a water leak, produced a temporary increase, and an H- steady-state level similar to that from a single 30 mg cesium deposition. Deposition of 0.1 g with a cesium plasma produced one half the H- yield obtained by deposition of the same amount of cesium atoms. A higher steady-state H- current value and a smaller rate of H- yield decrease was recorded during the 8 filaments discharge operation, as compared to the 12 filaments operation at the same discharge power.
Author
Optimization; Cesium; Cesium Ions; Deposition; Plasmas (Physics); Computational Grids

20000030662 Texas Technological Univ., Dept. of Electrical Engineering, Lubbock, TX USA
Study of Dusty Plasmas ***Final Report, 1 Nov. 1996 - 31 Oct. 1999***
Ishihara, Osamu, Texas Technological Univ., USA; Jan. 31, 2000; 7p; In English
Contract(s)/Grant(s): F49620-97-1-0007; AF Proj. 2301
Report No.(s): AD-A373420; AFRL-SR-BL-TR-00-0022; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

This progress report describes research work performed at Texas Tech University under AFOSR Grant No. F49620-97-1-0007 during the period of November 1,1996 to October 31, 1999. Theoretical and computational study of collective effects in dusty plasmas revealed (1) formation of oscillatory wake potential behind a highly charged dust grain placed in the ion flow in the sheath, (2) stable polygon structures formed by a collection of trapped dust particulates in the wake potential minima, (3) low frequency oscillations of order 10Hz associated with the polygon plasma crystal structure, (4) interaction of dust particulates and plasma particles through Hamiltonian formulation, (5) low frequency lattice oscillations (1 Hz) described by Hamiltonian formulation, (6) The attractive interaction between dust particulates through exchange of phonons, (7) polarization of a dust grain in the order of a Debye length, (8) the higher threshold of the dust ion-acoustic instability with the effect of dust-charging process, and (9) Buneman-type streaming instability in a dust plasma developed in a subsonic ion flow.
DTIC
Plasmas (Physics); Ion Sheaths; Crystal Structure; Dust; Magnetohydrodynamic Stability

20000030665 Florida Agricultural and Mechanical Univ., FSU Coll. of Engineering, Tallahassee, FL USA
The Effects of Carbon Particles on Aqueous Phase Pulsed Streamer Corona, ***Jan. 1996 - 1998***
Grymonpre, David R., Florida Agricultural and Mechanical Univ., USA; Nov. 02, 1998; 190p; In English
Contract(s)/Grant(s): F08635-93-C-0020; AF Proj. 1900
Report No.(s): AD-A373441; AFRL-ML-TY-TR-1999-4552; No Copyright; Avail: CASI; A02, Microfiche; A09, Hardcopy

Pulsed streamer corona technology utilizes a non-thermal plasma high voltage discharge to break down various airborne and aqueous phase organic pollutants. Pulsed streamer corona discharge in a reactor using a point-to-plane electrode geometry has been studied with well-mixed aqueous solutions containing various salts (sodium chloride, potassium chloride, and calcium chloride) and particles in suspension (powdered activated carbon, porous silica gel, non-porous glass spheres, and elemental copper). The result that solution conductivity governs the electrode breakdown voltage is independent of both the salt composition and the particle properties (i.e., total surface area, particle size, conductivity, and dielectric constant). Powdered activated carbon in aqueous suspension also dramatically reduces the reactor electric power as a function of applied voltage. Elemental analysis using PIXE (proton-induced x-ray emission) of the activated carbon and the water leachate from washed activated carbon, coupled with pulsed corona treatment experiments using washed activated carbon, show that interactions of activated carbon with potassium salts are responsible for the lower reactor power. With the lower power consumption, greater amounts of contaminants can be removed at a lower power usage. The combination of pulsed corona and activated carbon enhances phenol removal through bulk reactions, adsorption, and corona-induced surface reactions. Primary oxidation products of phenol were also measured. A reaction and diffusion model was derived to analyze the phenol decomposition with combined bulk liquid and particle surface reactions.
DTIC
Water Pollution; Activated Carbon; Electric Corona; Aqueous Solutions; Chemical Analysis; Adsorption; Contaminants; Plasma Jets; Thermal Plasmas

20000030683 National Inst. for Fusion Science, Toki, Japan

ICRF Waveform Controlling

Zhao, Y., Chinese Academy of Sciences, China; Torii, Y., National Inst. for Fusion Science, Japan; Mutoh, T., National Inst. for Fusion Science, Japan; Kumazawa, R., National Inst. for Fusion Science, Japan; Shimpo, F., National Inst. for Fusion Science, Japan; Seki, T., National Inst. for Fusion Science, Japan; Saito, K., National Inst. for Fusion Science, Japan; Nomura, G., National Inst. for Fusion Science, Japan; Watari, T., National Inst. for Fusion Science, Japan; December 1999; ISSN 0915-6356; 26p; In English

Report No.(s): NIFS-TECH-8; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Heating techniques have been researched and developed for high power and steady state operation of ion cyclotron range of frequencies (ICRF) heating on the Large Helical Device (LHD) in recent years. As a part of the heating system, the waveform control system plays an important role in ICRF heating experiments. This report describes the radio frequency (RF) waveform control system, the programming analysis, and hardware setup. Finally, some typical waveform examples generated by this RF waveform control system, and experimental results are given. The experimental results show that this RF waveform control system works quite well.

Author

Cyclotron Frequency; Ion Cyclotron Radiation; Procedures; Waveforms; Radio Frequency Heating; Frequency Control

20000031355 Moscow Inst. of Physics and Technology, Moscow, Russia

Superfast Homogeneous Plasma Ignition of Hydrogen-Oxygen and Air-Fuel Supersonic Flows by High-Voltage Ionization Wave ***Final Report, 1 Jan. - 15 Dec. 1999***

Starikovskii, Andrei Yu.; Dec. 15, 1999; 205p; In English

Report No.(s): AD-A373199; EOARD-SPC-99-4007; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

This report results from a contract tasking Moscow Inst. of Physics and Technology as follows: 1) The contractor will perform experiments on ignition initiation by ionization wave in the H2-O2 mixture. Determine the ignition threshold shift. Study the combustion uniformity and synchronization in the system. 2) He will determine the active particle formation rate in ionization wave with the nanosecond time resolution. Measure electric field of ionization wave in hydrogen. Develop a numerical model determining the active particles generation in the fast ionization wave. Verify the numerical model with the use of experimental data.

DTIC

Plasmas (Physics); Ignition; High Voltages; Ionization; Supersonic Flow; Plasma Physics

20000031359 Rutgers - The State Univ., Piscataway, NJ USA

Transport Processes in Plasmas ***Final Report, 1 Jul. 1996 - 30 Jun. 1999***

Lebowitz,; Jun. 30, 1999; 15p; In English

Contract(s)/Grant(s): F49620-96-1-0281; AF Proj. 3484

Report No.(s): AD-A373238; AFRL-SR-BL-TR-00-0019; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The AASERT Grant supported two students at Rutgers University, Mr. Dov Cheist and Mr. Kevin Rosema. Dov Chelst received his Ph.D. in May 1999. The title of his thesis was ”Modified Two Component Plasmas and Generalizations of Schwarz’s Lemma”. Dov’s thesis dealt with statistical mechanics of one dimensional systems with Coulomb interactions. Mr. Kevin Rosema was supported by this grant for the period of one year. He is currently continuing his graduate studies and expect to finish at the end of this year. His work on the grant involved fluctuations in Coulombic type systems.

DTIC

Plasmas (Physics); Plasma Physics

20000031381 Department of the Navy, Washington, DC USA

Organic Waste Disposal System

Nolting, Eugene E., Inventor; Colfield, Jon, Inventor; Richard, Roy, Inventor; Peterson, Steven, Inventor; Sep. 28, 1999; 5p; In English; Supersedes , AD-D019346

Patent Info.: Filed 9 Sep. 97,; US-Patent-Appl-SN-08-925-994; US-Patent-5-960-026

Report No.(s): AD-D019585; No Copyright; Avail: US Patent and Trademark Office, Microfiche

Organic waste material is pneumatically transported within air and mixed there with by swirling flow through an annular injector passage of varying radial width into a reaction flow passage of an educator nozzle section receiving the output plume of

a plasma torch for initiating therein thermal gasification of the waste mixture. The plasma torch plume projects from the educator section into a diffuser section within which thermal gasification is continued before discharge of gasified waste.
DTIC
Organic Materials; Waste Disposal; Patents; Patent Applications

20000031746 Department of the Navy, Washington, DC USA
Method and Apparatus for Transporting an Intense Ion Beam
Slinker, Steven P., Inventor; Hubbard, Richard F., Inventor; Lampe, Martin, Inventor; Joyce, Glenn, Inventor; Jul. 27, 1999; 7p; In English; Supersedes US-Patent-Appl-SN-07801248, AD-D015398.
Patent Info.: Filed 3 Dec. 91,; US-Patent-Appl-SN-07,801,248; US-Patent-5,930,313
Report No.(s): AD-D019534; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A method and apparatus for transporting a positive ion beam to a distant target. An ion channel is created as a path to the target, and the beam injected into the channel at a mildly- relativistic beam velocity. Because the beam is mildly- relativistic, the electric field caused by its positive charge propagates wet in advance of the beam, attracting free electrons in the plasma channel and pulling them into the beam along its axis of propagation. The current which is initiated by this precursor electron flow, is sustained during the duration of the beam, and is then a combination of the beam current and additional current carried by the electrons within the channel. As a result, a magnetic flux circulates annularly about the beam of a sufficient magnitude to pinch the beam.
DTIC
Particle Beams; Patents; Plasmas (Physics); Particle Motion; Electron Beams; Beam Currents

20000031980 Department of the Navy, Washington, DC USA
Acoustically Driven Plasma Antenna
Anderson, Theodore R., Inventor; Mar. 22, 1999; 22p; In English
Patent Info.: Filed 22 Mar. 1999; US-Patent-Appl-SN-09/273,817
Report No.(s): AD-D019515; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

A plasma antenna with an acoustic modulator is provided. An ionizer produces a plasma in a horizontal tube to form a bounded plasma column extending along a longitudinal axis. An amplitude-, phase- or frequency-modulated signal is applied to an acoustic transducer that directs an acoustic wave along the longitudinal axis into the plasma. The acoustic wave acts as an ion acoustic wave to oscillate ions parallel to the axis. This movement radiates an amplitude-, phase- or frequency- modulated electromagnetic field from the plasma column.
DTIC
Electroacoustic Transducers; Patent Applications; Ion Acoustic Waves; Plasma Antennas; Sound Waves; Plasmas (Physics)

20000032031 National Inst. for Fusion Science, Toki, Japan
Sparseness of Nonlinear Coupling
Goto, Susumu, National Inst. for Fusion Science, Japan; Kida, Shigeo, National Inst. for Fusion Science, Japan; December 1999; ISSN 0915-633X; 20p; In English
Report No.(s): NIFS-617; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

It is not weakness of nonlinearity but sparseness of nonlinear couplings that plays a key role in the direct interaction approximation (DIA), which is an excellent moment closure theory for nonlinear dynamical systems. Homogeneous Navier-Stokes turbulence is an example of dynamical systems in which nonlinearity is strong in magnitude but sparse in coupling. In order to clarify the importance of sparseness of coupling, we formulate DIA for a model equation which has three parameters: coupling density, strength of nonlinearity and the number of degrees of freedom. by the help of numerical simulations, it is shown that DIA is applicable when the coupling density is much smaller than the square root of the number of degrees of freedom, even if the strength of nonlinearity is infinitely large. This implies that the applicability of DIA has nothing to do with the Gaussianity of a dynamical variable, although DIA is often explained as a theory based on it.
Author
Nonlinear Systems; Dynamical Systems; Couplings; Approximation; Homogeneous Turbulence

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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.

20000028389 Wisconsin Univ., Dept.of Chemical Engineering, Madison, WI USA
Photoluminescence of Erbium-Implanted GaN and in situ-Doped GaN:Er
Hansen, D. M., Wisconsin Univ., USA; Zhang, R., Wisconsin Univ., USA; Perkins, N. R., Wisconsin Univ., USA; Safvi, S., Wisconsin Univ., USA; Zhang, L., Wisconsin Univ., USA; Bray, K. L., Wisconsin Univ., USA; Kuech, T. F., Wisconsin Univ., USA; Applied Physics Letters; Mar. 09, 1998; ISSN 0003-6951; Volume 72, No. 10, pp. 1244-1246; In English
Contract(s)/Grant(s): DAAH04-95-I-0322
Report No.(s): AD-A369998; ARO-34450.30-MS; Copyright; Avail: Issuing Activity, Microfiche, Hardcopy

The photoluminescence of in situ-doped GaN:Er during hydride vapor phase epitaxy was compared to an Er-implanted GaN sample. At 11 K, the main emission wavelength of the in situ-doped sample is shifted to shorter wavelengths by 2.5 nm and the lifetime is 2.1 +/-0.1 ms as compared to 2.9+/-0.1 ms obtained for the implanted sample. The 295 K band. edge luminescence of the in situ-doped sample vas free of the broad band luminescence centered at 500 nm which dominated the spectrum of the implanted sample. Reversible changes in the emission intensity of the in situ-doped sample upon annealing in a N2 versus a NH3/H2 ambient indicate the probable role of hydrogen in determining the luminescence efficiency of these samples.
Author
Doped Crystals; Erbium; Photoluminescence; Implantation

20000028390 Wisconsin Univ., Dept. of Chemical Engineering, Madison, WI USA
Incorporation of Er into GaN by in-situ Doping During Halide Vapor Phase Epitaxy
Zhang, Rong, Wisconsin Univ., USA; Kuech, T. F., Wisconsin Univ., USA; Materials Research Society Symposium Proceedings; 1996; Volume 512, pp. 327-332; In English
Contract(s)/Grant(s): DAAH04-95-I-0322
Report No.(s): AD-A369990; ARO-34450.32-MS; Copyright; Avail: Issuing Activity, Microfiche, Hardcopy

The incorporation of Er into GaN by in-situ doping during halide vapor phase epitaxy has been investigated. The NH3, HCl, metallic Ga and Er were used as source materials, while N2 was employed as a carrier gas. The GaN:Er films were obtained at different Ga/Er source temperatures. The Secondary Ion Mass Spectrometry (SIMS) analysis shows that the steady state Er doping concentration can be as high as 2x 10(exp 18) / cubic cm. All in-situ Er-doped samples luminescence at 1.54 microns due to the (4)I(13/2) yields (4)I(15/2) transition of Er3+ at both low (11K) and room temperature. The higher the Ga/Er boat temperature, the stronger the 1.54 micron luminescence, implying a higher incorporation ring of Er into the GaN. The (4)I(11/2) yields (4)I(15/2) transition luminescence, centered around 980 nm, can also be detected at both low and room temperature. The broad-spectrum PL measurements exhibited sharp band edge luminescence without the presence of the yellow luminescence band.
Author
Doped Crystals; Vapor Phase Epitaxy; Erbium Compounds; Semiconductors (Materials); Gallium Nitrides; Luminescence

20000031644 North Carolina State Univ., Raleigh, NC USA
Selected Energy Epitaxial Deposition (SEED) and Low Energy Electron Microscopy (LEEM) of AlN, GaN and SiC Thin Films *Final Report*
Davis, Robert F.; Feb. 09, 2000; 9p; In English
Contract(s)/Grant(s): N00014-95-1-0122; Proj-
Report No.(s): AD-A373469; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The report objectives are: (1) Optimize low-temperature growth of GaN using seeded supersonic molecular beams of NH3 and triethylgallium (TEG); (2) Determine the optimum growth parameters by conducting in situ real-time observations of the heteroepitaxial growth of GaN(0001) on 6H-SiC(0001) substrates using the SSJ source seeded with NH3 with the low-energy electron microscope (LEEM); and (3) Investigate effects of precursor translational energy on growth kinetics and morphology of GaN films.
DTIC
Thin Films; Silicon Carbides; Gallium Nitrides; Aluminum Nitrides; Real Time Operation; Epitaxy; Deposition

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20000027695 General Accounting Office, Accounting and Information Management Div., Washington, DC USA
Year 2000 Computing Challenge: Leadership and Partnerships Result in Limited Rollover Disruptions. Statement of Joel C. Willemssen Director, Civil Agencies Information Systems Accounting and Information Management Division
Jan. 27, 2000; 30p
Report No.(s): PB2000-102328; GAO/T-AIMD-00-70; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objectives of the review were to assess and report on the response of the Information Coordination Center (ICC) and key federal agencies during the century rollover period, and the nature and extent of Y2K induced disruptions that occurred during the rollover period. In addition, the report contains lessons learned by the government and others while correcting their Year 2000 problems.
NTIS
Information Systems; Systems Management; Computer Systems Performance; Software Reliability

20000028280 NASA, Washington, DC USA
Issue in NASA Program and Project Management. Special Edition: A Collection of Papers on NASA Procedures and Guidance 7120.5A, Volume 14
Hoffman, Edward J., Editor, NASA, USA; Lawbaugh, William M., Editor, Technical and Administrative Services Corp., USA; Spring 1998; 56p; In English; See also 20000028281 through 20000028285
Report No.(s): NASA/SP-1998-6101/VOL14; NAS 1.21:6101/VOL14; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A key aspect of NASA's new Strategic Management System is improving the way we plan, approve, execute and evaluate our programs and projects. to this end, NASA has developed the NASA Program and Project Management processes and Requirements-NASA Procedures and Guidelines (NPG) 7120.5A, which formally documents the "Provide Aerospace Products and Capabilities" crosscutting process, and defines the processes and requirements that are responsive to the Program/Project Management-NPD 7120.4A. The Program/Project Management-NPD 7120.4A, issued November 14, 1996, provides the policy for managing programs and projects in a new way that is aligned with the new NASA environment. An Agencywide team has spent thousands of hours developing the NASA Program and Project Management Processes and Requirements-NPG 7120.5A. We have created significant flexibility, authority and discretion for the program and project managers to exercise and carry out their duties, and have delegated the responsibility and the accountability for their programs and projects.
Derived from text
NASA Programs; Management Systems; Project Management; Policies; Education

20000028281 NASA, Washington, DC USA
The Impact of NPG 7120.5A Upon Training and Development
Hoffman, Edward J., NASA, USA; Issue in NASA Program and Project Management. Special Edition: A Collection of Papers on NASA Procedures and Guidance 7120.5A; Spring 1998, pp. 11-23; In English; See also 20000028280; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

NASA Procedures and Guidance 7120.5A for Program and Project Management Processes and Requirements should have minimal effect upon current Agency training and development programs - mainly because the new directive simply formalizes what we have been teaching and learning in the NASA Program/Project Management Initiative all along. A frequent complaint we get from the 8,000 or so graduates of our PPMI courses over the years, however, deals with resistance to what they may have learned in the classroom or training site. Brimming with new ideas, these young men and women often run up against an entrenched program or project manager who insists that things be done "the old way," too often perceived as "the NASA way" or even "the Goddard way." Management was all too often in the eyes of the manager; now we're all reading from the same book, 7120.5A, Still, there is no single method or "one size fits all" approach to project management in NASA. While each Center is responsible for developing policies, processes and procedures to comply with the new NPG, individual program and project managers will still need to tailor their requirements to the specific needs of the project, consistent with the size, complexity, risk and criticality of the project. Under NPG 7120.5A, the results of such tailoring are to be documented in agreements among managers, directors, Enterprise Associate Administrators and the Administrator.
Derived from text
Project Management; Education; NASA Programs

20000028282 NASA Marshall Space Flight Center, Huntsville, AL USA

NASA Procedures and Guidance 7120.5A: An Overview

Griner, Carolyn S., NASA Marshall Space Flight Center, USA; Issue in NASA Program and Project Management. Special Edition: A Collection of Papers on NASA Procedures and Guidance 7120.5A; Spring 1998, pp. 3-9; In English; See also 20000028280; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The 1998 NASA Strategic Plan states that we are to deliver world-class programs and cutting-edge technology through a revolutionized NASA. Process and requirements must change to insure success in delivering those world-class programs. The 1996 Strategic Management Handbook defines the Agency's crosscutting processes: "Manage Strategically," "Provide Aerospace Products and Capabilities," "Generate Knowledge" and "Communicate Knowledge." The focus of this overview, and for the development of programs and projects, is the "Provide Aerospace Products and Capabilities" process. NASA Policy Document 7120.4A specifies the management system policy for the development and operation of programs and projects. NPG 7120.5A describes the next tier of requirements, integrating those crosscutting processes and process-focused requirements, making sure we can be flexible and efficient, providing the right kind of product delivery that meets user requirements.

Derived from text

Management Systems; Policies; Project Management; General Overviews; Aerospace Industry; Product Development

20000028283 NASA, Washington, DC USA

The NPG 7120.5A Electronic Review Process

McBrayer, Robert, NASA, USA; Ives, Mark, NASA, USA; Issue in NASA Program and Project Management. Special Edition: A Collection of Papers on NASA Procedures and Guidance 7120.5A; Spring 1998, pp. 25-33; In English; See also 20000028280; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The use of electronics to review a document is well within the technical realm of today's state-of-the-art workplace. File servers and web site interaction are common tools for many NASA employees. The electronic comment processing described here was developed for the NPG 7120.5A review to augment the existing NASA Online Directives Information System (NODIS). The NODIS system is NASA's official system for formal review, approval and storage of NASA Directives. The electronic review process worked so well that NASA and other agencies may want to consider it as one of our "best practices." It was participatory decision making at its very best, a process that attracted dozens of very good ideas to improve the document as well as the way we can be managing projects far more effectively. The revision of NPG 7120.5A has significant implications for the way all elements of the Agency accomplish program and project management. Therefore, the review of NPG 7120.5A was an Agencywide effort with high visibility, heavy participation and a short schedule. The level of involvement created interest in supplementing the formal NODIS system with a system to collect comments efficiently and to allow the Centers and Codes to review and consolidate their comments into the official system in a short period of time. In addition, the Program Management Council Working Group (PMCWG), responsible for the revision of the document and the disposition of official comments, needed an electronic system to manage the disposition of comments, obtain PMCWG consensus on each disposition, and coordinate the disposition with the appropriate Headquarters Code that had submitted the official comment. The combined NASA and contractor talents and resources provided a system that supplemented the NODIS system and its operating personnel to produce a thorough review and approval of NPG 7120.5A on April 3, 1998, 7.5 months from the start of the process. The original six-month schedule is indicated. All milestones occurred on time, except for completion of comment disposition, which required an additional 30 days. Approval of the document occurred sixteen days after completion of the "Purple Package."

Derived from text

Project Management; On-Line Systems; Electronic Equipment; Applications Programs (Computers); NASA Programs

20000028284 NASA, Washington, DC USA

Risk Management Structured for Today's Environment

Greenfield, Michael A., NASA, USA; Issue in NASA Program and Project Management. Special Edition: A Collection of Papers on NASA Procedures and Guidance 7120.5A; Spring 1998, pp. 35-40; In English; See also 20000028280; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

In NPG (NASA Procedures and Guidelines) 7120.5A, we define risk management as "an organized, systematic decision-making process that efficiently identifies, analyzes, plans, tracks, controls, and communicates and documents risk in order to increase the likelihood of achieving program/project goals." Effective risk management depends upon a thorough understanding of the concept of risk, the principles of risk management and the formation of a disciplined risk management process. In human spaceflight programs, NASA has always maintained a rigorous and highly structured risk management effort.

When lives are at stake, NASA's missions must be 100% safe; the risk management approach used in human spaceflight has always been comprehensive.
Derived from text
Risk; NASA Programs; Resource Allocation; Management Systems; Safety Management

20000029586 Aspen Systems Corp., Rockville, MD USA
Training Guides for the Head Start Learning Community: Cultivating Successful Management Teams
1999; 152p; In English
Contract(s)/Grant(s): HSB 105-94-1582
Report No.(s): PB2000-102826; No Copyright; Avail: CASI; A02, Microfiche; A08, Hardcopy

This technical guide strengthens the knowledge and skills of participants so they can effectively use a team approach to manage Head Start programs. This guide promotes the concept that effective management systems and team process skills are important tools that allow management teams to operate comprehensive, integrated, and collaborative Head Start programs. Successful Head Start management teams use the diverse knowledge and expertise of each member to turn challenges into opportunities. The cultural and linguistic diversity in families, organization structures and designs, program options, and geographic areas served all contribute to the challenges of an effective team approach to management. Productive management teams are able to turn challenges into opportunities by valuing, celebrating, respecting, and using the diverse skills of team members to accomplish common program goals.
NTIS
Management Systems; Cultivation

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.

20000028285 Technical and Administrative Services Corp., Washington, DC USA
Resources
Lawbaugh, William M., Technical and Administrative Services Corp., USA; Issue in NASA Program and Project Management. Special Edition: A Collection of Papers on NASA Procedures and Guidance 7120.5A; Spring 1998, pp. 41-51; In English; See also 20000028280; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

NASA maintains an online library for official documents called NASA Online Directives Information System (NODIS) Library that provides access to a wide range of requirements applicable to NASA programs and projects. This library is updated as new requirements are approved.
Derived from text
NASA Programs; On-Line Systems; Libraries; Resources Management; Computer Programs; Information Resources Management

20000028380 Department of Defense, Office of the Inspector General, Arlington, VA USA
Acquisition Management of the Joint Total Asset Visibility System
Dec. 14, 1999; 25p; In English
Report No.(s): AD-A373116; IG/DOD-D-2000-055; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report is the second in a series that evaluates the acquisition management of automated information systems. The Joint Total Asset Visibility automated information system is designed to provide timely and accurate logistics information on the location, movement, status, and identity of units, personnel, equipment, and supplies. The Joint Total Asset Visibility system is being acquired in two phases. Phase one is the Joint Total Asset Visibility In-Theater system that provides unified commanders with asset visibility for their commands. Phase two is the Joint Total Asset Visibility Global automated information system for the Joint Vision 2010 warfighting strategy. The Joint Total Asset Visibility program is a Special Interest Major Information Technology Initiative, which received operations and maintenance funding of $79 million through FY 1999.
DTIC
Information Systems; Management Planning

20000030742 NASA Langley Research Center, Hampton, VA USA

NASA Langley Scientific and Technical Information Output: 1999

Stewart, Susan H., Compiler, NASA Langley Research Center, USA; Machie, Harriet, Compiler, NASA Langley Research Center, USA; February 2000; 180p; In English

Report No.(s): NASA/TM-2000-209852; NAS 1.15:209852; L-17958; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

This document is a compilation of the scientific and technical information that the Langley Research Center has produced during the calendar year 1999. Included are citations for Special Publications, Technical Publications, Conference Publications, Technical Memorandums, Contractor Reports, Journal Articles and Book Publications, Meeting Presentations, Technical Talks, Tech Briefs, and Patents.

Author (revised)

Bibliographies; Research and Development; NASA Space Programs; Space Technology Experiments; Acoustics

20000031363 NASA Langley Research Center, Hampton, VA USA

Aerodynamic Characteristics, Database Development and Flight Simulation of the X-34 Vehicle

Pamadi, Bandu N., NASA Langley Research Center, USA; Brauckmann, Gregory J., NASA Langley Research Center, USA; Ruth, Michael J., Orbital Sciences Corp., USA; Fuhrmann, Henri D., Orbital Sciences Corp., USA; 2000; 18p; 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 2000-0900; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

An overview of the aerodynamic characteristics, development of the preflight aerodynamic database and flight simulation of the NASA/Orbital X-34 vehicle is presented in this paper. to develop the aerodynamic database, wind tunnel tests from subsonic to hypersonic Mach numbers including ground effect tests at low subsonic speeds were conducted in various facilities at the NASA Langley Research Center. Where wind tunnel test data was not available, engineering level analysis is used to fill the gaps in the database. Using this aerodynamic data, simulations have been performed for typical design reference missions of the X-34 vehicle.

Author

Aerodynamic Characteristics; Data Bases; Flight Simulation; Data Simulation; Wind Tunnel Tests

20000031390 NASA, Washington, DC USA

NASA University Program Management Information System, *FY 1999*

Jan. 01, 2000; 710p; In English

Report No.(s): NASA/TM-2000-210015; NAS 1.15:210015; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche

As basic policy, NASA believes that colleges and universities should be encouraged to participate in the nation's space and aeronautics program to the maximum extent practicable. Indeed, universities are considered as partners with government and industry in the nation's aerospace program. NASA:s objective is to have them bring their scientific, engineering, and social research competence to bear on aerospace problems and on the broader social, economic, and international implications of NASA's technical and scientific programs. It is expected that, in so doing, universities will strengthen both their research and their educational capabilities to contribute more effectively to the national well-being. NASA field codes and certain Headquarters program offices provide funds for those activities in universities which contribute to the mission needs of that particular NASA element. Although NASA has no predetermined amount of money to devote to university activities, the effort funded each year is substantial. This annual report is one means of documenting the NASA-university relationship, frequently denoted, collectively, as NASA's University Program. This report is consistent with agency accounting records, as the data is obtained from NASA:s Financial and Contractual Status (FACS) System, operated by the Financial Management Division and the Procurement Office. However, in accordance with interagency agreements, the orientation differs from that required for financial or procurement purposes. Any apparent discrepancies between this report and other NASA procurement or financial reports stem from the selection criteria for the data.* This report was prepared by the Education Division/FE, Office of Human Resources and Education, using a management information system which was modernized during FY 1993.

Author

Management Information Systems; University Program; NASA Programs; Education; Project Management

20000031734 Naval War Coll., Newport, RI USA
Information Warfare: Defining the Legal Response to An Attack ***Final Report***
Pottorff, James P.; May 17, 1999; 15p; In English
Report No.(s): AD-A372757; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper discusses the difficulty in determining whether an information warfare attack, such as a computer virus, can be treated as an ”armed attack” for purposes of national defense under the United Nations charter. As the U.S. and its allies become increasingly sophisticated in information operations, corresponding development of appropriate international law protecting these operations has been exceedingly slow. In this regard, the paper identifies U.S. vulnerabilities, particularly to as asymmetrical attacks, and provides recommended changes to law and policy.
DTIC
Policies; Warfare; United Nations

84
LAW, POLITICAL SCIENCE AND SPACE POLICY

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

20000029497 National Academy of Sciences - National Research Council, Committee on International Space Programs, Washington, DC USA
US-European-Japanese Workshop on Space Cooperation
[1999]; 82p; In English; Space Cooperation, May 1999, Tokyo, Japan; See also 20000029498 through 20000029504
Contract(s)/Grant(s): NASW-96013; 99-20; Copyright; Avail: Issuing Activity

A trilateral workshop on space cooperation hosted by the Space Research Committee (SRC) of the Science Council of Japan-and including representatives of the Committee on International Space Programs (CISP) of the Space Studies Board (SSB), National Research Council (NRC), and the European Space Science Committee (ESSC) of the European Science Foundation (ESF)-was held in Tokyo at the Science Council of Japan on May 19-21, 1999. The purpose of the workshop was to: 1. Assist independent space science advisory bodies in Europe and the USA to establish a relationship with like bodies in Japan; 2. Begin this relationship by examining the nature of trilateral, cooperative space missions conducted during the last decade; 3. Understand better the primary factors that led to successful collaboration, explore the benefits and costs of cooperation, and identify major problems; and 4. Review the status of several embryonic projects-and consider broader issues such as the possibility of coordinated, international strategic planning for space science and other policy issues likely to be significant in the future.
Derived from text
Europe; Japan; Space Programs; Aerospace Sciences; International Cooperation; USA

20000029498 NASA Goddard Space Flight Center, Greenbelt, MD USA
International Cooperation With Japan in the International Solar-Terrestrial Physics/GGS Program
Acuna, M. H., NASA Goddard Space Flight Center, USA; US-European-Japanese Workshop on Space Cooperation; [1999], pp. 28-32; In English; See also 20000029497; Copyright; Avail: Issuing Activity

The origin of the Geotail Program and the collaboration with Japan traces back to the Origin of Plasmas in the Earth’s Neighborhood (OPEN) Program, a fleet of four spacecraft studied at the National Aeronautics and Space Administration (NASA) Goddard Space Flight Center (GSFC) in the early 1980s to conduct multipoint, coordinated measurements in the Earth’s magnetosphere and the interplanetary medium. The OPEN program was the natural evolution of the early discovery missions, which although finding many new regions and plasmaphysical phenomena in the magnetosphere had problems separating cause-and effect relationships and resolving space-time ambiguities. The primary scientific objective was the coordinated study of the flow of energy, mass, and momentum from the Sun through the interplanetary medium and its eventual deposition in the Earth’s atmosphere. This objective was to be achieved in a quantitative manner and to that extent theory, models, and ground-based observations were incorporated for the first time as an integral part of the project baseline. An ambitious ground system, capable of processing and visualizing the vast amounts of data generated by these spacecraft, was also conceived and incorporated in the OPEN concept.
Author
International Cooperation; Japan; Solar Terrestrial Interactions; Plasmas (Physics); Geomagnetic Tail

20000029499 Tokyo Univ., Inst. of Space and Astronautical Science, Japan

International Cooperation in the Geotail Program

Nishida, A., Tokyo Univ., Japan; US-European-Japanese Workshop on Space Cooperation; [1999], pp. 23-27; In English; See also 20000029497; Copyright; Avail: Issuing Activity

To investigate the geomagnetic tail region of the magnetosphere, the Institute of Space and Astronautical Science (ISAS) and the National Aeronautics and Space Administration (NASA) under-took a joint project to develop, launch, and operate a scientific satellite designated Geotail satellite. The Geotail mission was to measure energy flow and transformation in the magnetotail to increase understanding of fundamental magnetospheric processes, including the physics of the magnetopause, the plasma sheet, and reconnection and neutral line formation. to conduct these measurements, Geotail took two orbit phases: a nightside double lunar swingby orbit to distances of 220 Re and a low inclination orbit at geocentric distances of about 10 to 50 Re and then to 30 Re. The Geotail satellite was designed and developed by ISAS and was launched by NASA by a Delta II in July 1992.
Derived from text

International Cooperation; Geomagnetic Tail; Scientific Satellites; Geomagnetism; Earth Magnetosphere

20000029500 Tokyo Univ., Inst. of Space and Astronautical Science, Japan

International Cooperation in the Yohkoh Program

Kosugi, T., Tokyo Univ., Japan; US-European-Japanese Workshop on Space Cooperation; [1999], pp. 35-40; In English; See also 20000029497; Copyright; Avail: Issuing Activity

The Yohkoh satellite, formerly named Solar-A before launch, is the second X-ray solar-physics satellite of the Institute of Space and Astronautical Science (ISAS), and was launched by an M-3S-11 launch vehicle on August 30, 1991. It is fully operational even after 7 years have elapsed and is expected to be so during the coming solar maximum in 2000-2001. The Yohkoh mission aims at unveiling energy-release and particle-acceleration processes in solar flares, as well as at deeply understanding structures and dynamics seen in the solar corona. to achieve these goals, it carries four scientific instruments: (1) a hard X-ray telescope (HXT), (2) a soft X-ray telescope (SXT), (3) a set of wideband spectrometers, and (4) a set of Bragg crystal spectrometers (BCSs). Each of the four instruments has its own advantages over its predecessors, but more important is that these four instruments were so designed as to principally observe a single object, that is, a solar flare. The intention was to obtain a coordinated set of complementary observations taken simultaneously. This goal has been fully achieved, resulting in fruitful scientific return not only in number (467 papers in refereed journals, 597 proceedings papers, 34 Ph.D. theses, and 39 master's theses as of August 1998) but also in quality. From the beginning, Yohkoh was planned by ISAS as an international collaborative mission with the National Aeronautics and Space Administration (NASA-USA) and Science and Engineering Research Council (SERC; at present the Particle Physics and Astronomy Research Council-UK) as international partners. Inside Japan, the Yohkoh collaboration includes the National Astronomical Observatory of Japan (NAOJ), major universities, and others.
Derived from text

International Cooperation; Astronomical Observatories; Solar Physics; Japanese Spacecraft; Japanese Space Program; X Ray Telescopes

20000029501 Mullard Space Science Lab., Dorking, UK

Yohkoh: The View From Europe. An Account of the Collaborative Production of the UK/US/Japanese Bragg Crystal Spectrometer

Culhane, J. L., Mullard Space Science Lab., UK; US-European-Japanese Workshop on Space Cooperation; [1999], pp. 41-44; In English; See also 20000029497; Copyright; Avail: Issuing Activity

Japan, U.S., and U.K. research groups had flown three high-resolution Bragg Crystal X-ray spectrometers in the early 1980s. The instruments-on the Hinotori (National Astronomical Observatory of Japan (NAOJ) Institute for Space and Astronautical Science (ISAS), P78-1 (U.S. Naval Research Laboratory (NRL) an Solar Maximum Mission (SMM) / (Lockheed/Mullard Space Science Laboratory (MSSL) / Rutherford Appleton Laboratory (RAL)) spacecraft-obtained several important results on solar flares and active regions. The Bragg crystal spectrometer (BCS) was accepted for flight on Solar-A (Yohkoh) by ISAS in late 1986. The U.K. Science and Engineering Research Council (SERC) support for MSSL and RAL, and U.S. NRL internal funding from its E.O. Hulburt Center for Space Research, were agreed on in January 1987, and instrument heritage was derived from the U.K.-designed curved or bent crystal spectrometer, which was flown on the National Aeronautics and Space Administration (NASA) SNM in February 1980. This configuration was chosen because: 1) The Yohkoh mission plan emphasized solar flare observations with focus on time and spectral but not spatial resolution; 2) Flight heritage existed from the instrument; 3) An

instrument with 10 times greater sensitivity than its predecessors could be accommodated on Yohkoh; and 4) A conventional scanning spectrometer would have been massive and complex.
Derived from text
Japanese Spacecraft; Bragg Angle; X Ray Spectrometers; Europe; USA; UK

20000029502 California Univ., San Diego, CA USA
Comments on the Solar-A (Yohkoh) Mission
Hudson, H. S., California Univ., USA; US-European-Japanese Workshop on Space Cooperation; [1999], pp. 45-50; In English; See also 20000029497; Copyright; Avail: Issuing Activity

The Solar-A spacecraft, which became Yohkoh upon launch, was the second Sun-observing satellite of the Institute of Space and Astronautical Science (ISAS), following Hinotori (1981). The participants in Solar-A were ISAS and other Japanese institutions under the ISAS lead, plus various U.S. and U.K. institutions under the management of the National Aeronautics and Space Administration (NASA) and Science and Engineering Research Council (later the Particle Physics and Astronomy Research Council, PPARC). The fundamental objective of Solar-A was the study of solar flares at high energies-these were the Hinotori target as well-and the mission continues successfully at present, following an August 1991 launch. The author of these notes acted as a go-between during the original planning of the U.S. participation in Solar-A, aided NASA in the selection of its team, and since launch has acted as the senior resident U.S. representative for mission operations and science.
Derived from text
Japanese Spacecraft; Solar Flares; Space Missions; Spacecraft Launching

20000029503 Tokyo Univ., Japan
International Cooperation on the ASCA Program
Makishima, K., Tokyo Univ., Japan; US-European-Japanese Workshop on Space Cooperation; [1999], pp. 53-59; In English; See also 20000029497; Copyright; Avail: Issuing Activity

ASCA, meaning ”flying bird” in Japanese, and also the acronym for Advanced Satellite for Cosmology and Astrophysics, is the fourth Japanese cosmic X-ray satellite, launched in February 1993, This mission includes a significant contribution from the USA supported by the National Aeronautics and Space Administration (NASA). The scientific objective of ASCA is to perform high-sensitivity imaging spectroscopic studies of cosmic high-energy phenomena, covering a broad energy band of 0.5-10 keV. In particular, ASCA is the world’s first satellite that can take X-ray images of celestial objects in energies above 4 keV. Furthermore, the ASCA instruments have much better spectral resolution than most of the previously flown cosmic X-ray instruments. The Japanese-U.S. collaboration on ASCA has been implemented in the following way. The X-ray instruments of ASCA have been developed in close collaboration with U.S. scientists based on the agreement between the Institute for Space and Astronautical Science (ISAS) and NASA. These instruments are designed, fabricated, tested, and calibrated as a joint effort of the Japanese and U.S. scientists involved. Also, the U.S side gives a major contribution in the software development and data archiving, and NASA provides partial support to the data acquisition utilizing the Deep Space Network (DSN). The cooperation has been based on three principles. The first is ”no exchange of funds,” for obvious practical reasons. The second is to conduct the collaboration in a grassroots manner based on scientist-to-scientist contact, with the least amount of bureaucratic formality possible. Finally, there should be no ”black box”; an instrument fabricated in either Japan or the USA should have collaborating groups in both countries, so that its performance is fully understood by both parties.
Derived from text
International Cooperation; Astrophysics; Cosmology; Imaging Techniques; X Ray Astronomy

20000029504 Rutgers Univ., Piscataway, NJ USA
Perspectives on Astro-D/ASCA
Hughes, John, Rutgers Univ., USA; US-European-Japanese Workshop on Space Cooperation; [1999], pp. 60-63; In English; See also 20000029497; Copyright; Avail: Issuing Activity

This paper presents perspectives on ASTRO-D/ASCA (Advanced Satellite for Cosmology and Astrophysics formerly ASTRO-D). The topics include: 1) Timeline of Major U.S. Events on Astro-D; 2) Important Players in the ASCA Project on the U.S. Side; 3) U.S. Contributions to Astro-D; 4) History of CCD Development at MIT (Ricker); 5) History of Thin-Foil Conical Mirror Development at GSFC (Serlemitsos); 6) Cooperation: Net Benefits of Collaboration; and 7) Lessons Learned, Concerns, and Issues for Future Collaborations.
CASI
Astrophysics; Cosmology; X Ray Astronomy

89
ASTRONOMY

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

20000027673 National Optical Astronomy Observatories, Tucson, AZ USA
The Spectrum of the Night Sky over Mount Hopkins and Kitt Peak: Changes after a Decade
Massey, Philip, Kitt Peak National Observatory, USA; Foltz, Craig B., Multiple-Mirror Telescope Observatory, USA; January 2000; 20p; In English
Report No.(s): NOAO-Preprint-863; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Recent (1998-1999) absolute spectrophotometry of the night sky over two Southern Arizona astronomical sites, Kitt Peak and Mt. Hopkins, is compared to similar data obtained in 1988 at each site. The current zenith sky brightness in the range approx. 3700 - 6700 A is essentially identical at the two sites, and is as dark now as Palomar Observatory was in the early 1970s, when it was generally considered a premier dark observing site. Converted to broad-band measurements, our spectrophotometry is equivalent to B = 22.63, V - 21.45 mag /arcsec(exp 2) for the zenith night-sky. The contribution of high-pressure sodium street lights to broad-band V is about 0.2 mag/ arcsec(exp 2) comparable to the strong airglow O I (lambda)5577 line. During the period from 1988 to 1998-1999, the zenith sky brightness increased only modestly, with the largest changes being seen for Kitt Peak where the zenith sky has brightened by approx. = 0.1 - 0.2 mag/ arcsec(exp 2) in the blue-optical region. For Kitt Peak we also have both 1988 and 1999 observations at modestly large zenith distances (ZD approx. = 60 deg). In the directions away from Tucson, the sky has brightened by approx. = 0.35 mag/ arcsec(exp 2) over the intervening decade. Towards Tucson the change has been larger, approximately 0.5 mag /arcsec(exp 2). In most directions the increase in the sky brightness has lagged behind the fractional increase in population growth, which we attribute to good outdoor lighting ordinances, a fact which is further reflected in the decrease in Hg emission. However, our results emphasize the need for diligent attention as developments creep closer to our observing sites.
Author
Broadband; Creep Properties; High Pressure; Illuminating; Luminaires; Night Sky; Sky Brightness; Spectrophotometry

20000028358 National Optical Astronomy Observatories, Tucson, AZ USA
Algorithms for CCD Stellar Photometry
Mighell, Kenneth J., Kitt Peak National Observatory, USA; July 1999; 14p; In English
Report No.(s): NOAO-Preprint-846; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Basic algorithms for the production of stellar photometry from CCD observations are described and reviewed. Simple algorithms for detecting stars, finding their positions, and estimating the nearby sky background will be presented along with references to the extensive literature devoted to these topics. The basic techniques of aperture and PSF-fitting CCD stellar photometry are discussed in detail. Recent advances in PSF-fitting CCD stellar photometry are described and used to show how accurate V-band stellar photometry with the Next Generation Space Telescope could be accomplished with a 8-m primary mirror that is diffraction limited at near-infrared wavelengths.
Author
Algorithms; Charge Coupled Devices; Stellar Spectrophotometry

20000028359 National Optical Astronomy Observatories, Tucson, AZ USA
Cepheid Calibration of the Peak Brightness of SNe Ia., 9, SN 1989B in NGC 3627
Saha, A., National Optical Astronomy Observatories, USA; Sandage, Allan, Carnegie Institution of Washington, USA; Tammann, G. A., Basel Univ., Switzerland; Labhardt, Lukas, Basel Univ., Switzerland; Macchetto, F. D., Space Telescope Science Inst., USA; Panagia, N., Space Telescope Science Inst., USA; May 1999; 78p; In English
Contract(s)/Grant(s): GO-5427.02-93A
Report No.(s): NOAO-Preprint-837; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Repeated imaging observations have been made of NGC 3627 with the Hubble Space Telescope in 1997/98, over an interval of 58 days. Images were obtained on 12 epochs in the F555W band and on five epochs in the F8141,V band. The galaxy hosted the prototypical, ”Branch normal”, type la supernova SN 1989B. A total of 83 variables have been found, of which 68 are definite Cepheid variables with periods ranging from 75 days to 3.85 days. The de-reddened distance modulus is determined to be (m - M)(sub 0) = 30.22 +/- 0.12 (internal uncertainty) using a subset of the Cepheid data whose reddening and error parameters are secure. The photometric data of Wells et al. (1994), combined with the Cepheid data for NGC 3627 give MB(max) = -19.36 +/- 0.18 and M(sub V)(max) = -19.34 +/- 0.16 for SN 1989B. Combined with the previous six calibrations in this program, plus two

additional calibrations determined by others gives the mean absolute magnitudes at maximum of (M(sub B)) = -19.48 +/- 0.07 for ”Brunch normal” SNe Ia at this interim stage in the calibration program. Using the argument by Wells et al. (1994) that SN 1989B here is virtually identical in decay rate and colors at maximum with SN 198ON in NGC 1316 in the Fornax cluster, and that such identity means nearly identical absolute magnitude, it follows that the difference in the distance modulus of NGC 3627 and NGC 1316 is 1.62 +/- 0.03 mag. Thus the NGC 3627 modulus implies that (m - M)(sub 0) = 31.84 for NGC 1316. The second parameter correlations of M(max) of blue SNe la with decay rate, color at maximum, and Hubble type are re-investigated. The dependence of (M(max)) on decay rate is non-linear, showing a minimum for decay rates between 1.0 less than ADelta(sub m)15 less than 1.6. Magnitudes corrected for decay rate show no dependence on Hubble type, but a dependence on color remains. Correcting both the fiducial sample of 34 SNe la with decay-rate data and the current eight calibrating SNe la for the correlation with decay rate as well as color gives H(sub 0) = 60 +/- 2 (internal) km/s Mpc, in both B and V. The same value to within 4% is obtained if only the SNe la in spirals (without second parameter corrections) are considered. The correlation of SNe la color at maximum with M(max) cannot be due to internal absorption because the slope coefficients in B, V, and I with the change in magnitude are far from or even opposite to the canonical reddening values. The color effect must be intrinsic to the supernova physics. ”Absorption” corrections of distant blue SNe la will lead to incorrect values of H(sub 0). The Cepheid distances used in this series are insensitive to metallicity differences. The zeropoint of the P-L relation is based on an assumed LMC modulus of (m - M)(sub 0) = 18.50. As this may have to be increased by 0(sup m).06 to 0(sup m).08, all distances in this paper will follow and Ho will decrease by 3 - 4%.

Author

Brightness; Calibrating; Cepheid Variables; Decay Rates; Galactic Clusters; Interstellar Extinction; Stellar Spectra; Time Measurement

20000028360 National Optical Astronomy Observatories, Tucson, AZ USA

5000 by 5000 Spatial by 1500 Spectral Resolution Elements: First Astronomical Observations with a Novel 3-D Detector

Keller, C. U., National Solar Observatory, USA; July 1999; 16p; In English

Report No.(s): NOAO-Preprint-847; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

I present the first three-dimensional observations of the Sun obtained with a novel, highly wavelength-sensitive imaging detector. The all-optical device has a spectral resolution of 0.001 nm over a band of 15 nm centered at 634 nm and a spatial pixel size as small as a few microns squared over an area of several square centimeters. It is based on a dye- doped polymer film immersed in liquid helium that is exposed like film and can store true 3-D images with high spatial and spectral resolution. The optical stored information is read out with a tunable laser and a fast CCD camera. The characteristics of this novel detector have been studied with extensive laboratory tests, while observations of the Sun provided the first astronomical data. These initial experiments pave tile way for astronomical detectors that improve the efficiency of spectroscopy of extended sources by orders of magnitudes.

Author

Three Dimensional Motion; CCD Cameras; Sun; Observation; Spatial Resolution; Imaging Techniques

20000030682 National Optical Astronomy Observatories, Tucson, AZ USA

First Generation Instruments for the SOAR 4.25m Telescope

Cecil, Gerald, National Optical Astronomy Observatories, USA; March 2000; 12p; In English

Report No.(s): NOAO-Preprint-870; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Five SOAR instruments are being designed for high-resolution imaging/imaging spectrophotometry across the isokinetic field (5-arcmin in excellent conditions). Wavefront tilt will be sensed in instruments and corrected by jittering M3. Michigan State University will build a 4x4K near-TR imager. All optical instruments emphasize high UV throughput, and will use pairs of LTV-enhanced MIT/LL 2x4K CCD’s. Most detector arrays will be operated with SDSU-2 ”Leach” controllers, under control of LabVIEW. The University of Sdo Paulo will provide a 1500-element integral field lenslet array that is fiber- coupled to a compact spectrograph. VPH gratings will be used in this instrument and in the multi-slit spectrometer from the University of North Carolina at Chapel Hill. CTIO will provide an optical mosaic imager with ”trombone”-style ADC, and will also upgrade their IRS to a 1 x 1 K Hawaii 1 array that will use a large complement of existing gratings. Most instruments will be clustered at Nasmyth, where instrument payload totals 4000 kg. Facility units will allow calibration while another instrument is doing science. The baseline for mechanism (including detector array) control is LabVIEW under Linux in a CompactPCI chassis that is fiber-linked by MXI-3 to a dedicated PC. Instruments will support remote and queued operation.

Author

Telescopes; Design Analysis; High Resolution; Imaging Techniques; Infrared Detectors; Optical Equipment

20000030692 Nobeyama Radio Observatory, Nobeyama, Japan

Large Scale Mapping Observations of the CI (P-3(sub 1) - P-3(sub 0)) and CO (J = 3 - 2) Lines toward the Orion a Molecular Cloud

Ikeda, M., Tokyo Univ., Japan; Maezawa, Hiroyuki, Tokyo Univ., Japan; Ito, Tetsuya, Tokyo Univ., Japan; Saito, Gaku, Tokyo Univ., Japan; Sekimoto, Yutaro, Tokyo Univ., Japan; Yamamoto, Satoshi, Tokyo Univ., Japan; Tatematsu, Kenichi, Nobeyama Radio Observatory, Japan; Arikawa, Yuji, Nobeyama Radio Observatory, Japan; Aso, Yoshiyuki, Nobeyama Radio Observatory, Japan; Noguchi, Takashi, Nobeyama Radio Observatory, Japan; 1999; ISSN 0911-5501; 18p; In English

Contract(s)/Grant(s): MOESC-07CE2002; MOESC-11304010

Report No.(s): NRO-508; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Large scale mapping observations of the P-3(sub 1) - P-3(sub 0) fine structure transition of atomic carbon (CT 492 GHz) and the J = 3 - 2 transition of CO (346 GHz) to- ward the Orion A molecular cloud have been carried out with the Mt. Fuji telescope. The observations cover 9 square degrees. and include the Orion nebula N142 and the L1641 dark cloud complex. The CI emission extend over almost the entire region of the Orion A cloud and is surprisingly similar to that of C-13O (J = 1 - 0). The CO(J = 3 - 2) emission shows a more feature-less and extended distribution than CI. The CI/CO(J = 3 - 2) integrated intensity ratio shows a spatial gradient running from the north (0.10) to the south (1.2) of the Orion A cloud which we interpret as a consequence of the temperature gradient. On the other hand. the CI/C-13O(J = 1 - 0) intensity ratio shows no systematic gradient. We have found a good correlation between the CI and C-13O (J = 1 - 0) intensities over the Orion A cloud. This result is discussed oil the basis of photodissociation region models.

Author

Scale Models; Mapping; Molecular Clouds; Orion Nebula; Visual Observation

20000031321 Smithsonian Astrophysical Observatory, Cambridge, MA USA

A High Resolution Survey of the Disk of M31 ***Final Report, 1 May 1996 - 31 Oct. 1999***

Primini, Francis A., Smithsonian Astrophysical Observatory, USA; March 2000; 8p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAG5-3210; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This report describes research activities funded for SAO Proposal P3481-5-95, ”Monitoring the Center of M31”. Related activities for SAO Proposal P3486- 5-95, ”A High-Resolution Survey of the Disk of M31” are also described. The research involved the data analysis and interpretation of eleven separate ROSAT (Roentgen Satellite) HRI (High Resolution Imager) observations of the center and inner disk of M31, obtained between July, 1990 and January, 1997. A log of the individual data sets is given. All proposed observations were successfully carried out by the ROSAT Observatory, and standard data products were successfully generated for each observation. There were two basic thrusts to the research. First, we wished to monitor the x-ray source nearest the nucleus of M31, to search for anti-correlated radio/x-ray variability predicted by theoretical models for the source. We would also be able to assess the degree and range of variability of other x-ray sources in the central bulge of M31 and to estimate rates of transients. Secondly, we wished to survey the entire inner disk of M31, and in particular the region covered by the recent MIT wide-band and narrow-band surveys to identify x-ray counterparts to supernova remnants, OB associations, and young blue stars, in areas in which the ROSAT PSPC survey was confused. Results of each research project are summarized. Papers describing the results in more detail are in preparation.

Author

High Resolution; ROSAT Mission; Andromeda Galaxy; Disk Galaxies; Surveys; Radio Sources (Astronomy)

20000031336 Nobeyama Radio Observatory, Nobeyama, Japan

VLBA Observation of SiO Masers in the M Giant IRC-10414

Imai, Hiroshi, Tohoku Univ., Japan; Deguchi, Shuji, Nobeyama Radio Observatory, Japan; Miyoshi, Makoto, Mizusawa Astrogeodynamics Observatory, Japan; Publication of Astronomical Society; 1999; ISSN 0911-5501; Volume 51, pp. 1-6; In English

Contract(s)/Grant(s): MOESSC-10640238

Report No.(s): NRO-502; Copyright; Avail: Issuing Activity

We have mapped the M-giant star, IRC-10414, In the SiO J=1-0 v=1 line at 43.1 GHz with the VLBA (Very Large Baseline Array) with a spatial resolution of better than 0.5 mas. The maser spots spread over on a circle of a radius of about 7.1 mas. A velocity gradient in the east-west direction of approx. 0.7 km per second mas per second is found. Monitoring observations with Nobeyama 45-m telescope have shown that the intensity ratio of the SiO J =1-0 v =1 to v =2 maser line was quite unusual (5-40) for the period of 1997-1999 in this object; this ratio was known to be close to unity in many late-type stellar objects, but was known to deviate strongly from unity in young stellar objects. The unusual line intensity ratio of this star may suggest an chemical or

geometrical anomaly of the envelope of IRC-10414. A possible ring/disk model is discussed in order to explain the distribution of the maser spots in this object.
Author
Very Large Array (VLA); Silicon Oxides; Masers; M Stars; Radio Sources (Astronomy)

90
ASTROPHYSICS

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

20000028351 Nobeyama Radio Observatory, Nobeyama, Japan
The Ortho-to-Para Ratio Ammonia in the L1157 Outflow
Umemoto, T., National Astronomical Observatory, Japan; Mikami, Hitomi, Nobeyama Radio Observatory, Japan; Yamamoto, Satoshi, Tokyo Univ., Japan; Hirano, Naomi, Hitotsubashi Univ., Japan; 1999; ISSN 0911-5501; 18p; In English
Contract(s)/Grant(s): MOESSC-09640315
Report No.(s): NRO-505; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We have measured the ortho-to-para ratio of ammonia in the blueshifted gas of the L1157 outflow by observing the six metastable inversion lines from (J, K) = (1, 1) to (6, 6). The highly excited (5, 5) and (6, 6) lines were first detected in the low-mass star forming regions. The rotational temperature derived from the ratio of four transition lines from (3, 3) to (6, 6) is 130-140 K, suggesting that the blueshifted gas is heated by a factor of approximately 10 as compared to the quiescent gas. The ortho-to-para ratio of the NH3 molecules in the blueshifted gas is estimated to be 1.3-1.7, which is higher than the statistical equilibrium value. This ratio provides us with evidence that the NH3 molecules have been evaporated from dust grains with the formation temperature between 18 and 25 K. It is most likely that the NH3 molecules on dust grains have been released into the gas phase through the passage of strong shock waves produced by the outflow. Such a scenario is supported by the fact that the ammonia abundance in the blueshifted gas is enhanced by a factor of approximately 5 with respect to the dense quiescent gas.
Author
Ammonia; Line Spectra; Gas Density

20000028366 National Optical Astronomy Observatories, Tucson, AZ USA
Stellar Masses
Massey, Philip, Kitt Peak National Observatory, USA; Meyer, Michael R., Arizona Univ., USA; May 1999; 8p; In English
Report No.(s): NOAO-Preprint-836; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Arguably the mass of a star is its most, important property. In this article we will answer four questions concerning stellar masses. How do the properties of stars depend upon their masses? What is the smallest and largest mass possible for a star, and why? How do we determine the masses of stars? What distribution of stellar masses occurs when stars form, and why?
Author
Stellar Mass; Star Formation Rate

20000028415 Nobeyama Radio Observatory, Nobeyama, Japan
Period Measurement of AGB Stars in the Outer Galactic Disk
Nakashima, Junichi, Graduate Univ. for Advanced Studies, Japan; Jiang, B. W., Graduate Univ. for Advanced Studies, Japan; Deguichi, Shuji, Nobeyama Radio Observatory, Japan; Sadakane, Kozo, Osaka Kyoiku Univ., Japan; Nakada, Yoshikazu, Tokyo Univ., Japan; 1999; ISSN 0911-5501; 28p; In English
Contract(s)/Grant(s): MOESSC-08640337; MOESSC-10640238
Report No.(s): NRO-509; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Light variation of the 47 AGB star candidates in the outer Galactic disk has been monitored at I-band for 5 years. Periods were determined well for 18 of them and less reliably for the other 25. The average period of the objects is then 500 days. According to the period-luminosity relation, the mean luminosity of the sample stars is 10000 solar luminosity. Based on the absolute luminosity derived from the period-luminosity relation and the apparent luminosity from the observation, the distances to the objects are determined. The distances calculated are slightly greater than those obtained previously on the assumption of constant luminosity, of 8000 solar luminosity. In addition, SiO maser emission was detected for most of the observed objects so that, their

radial velocities were known accurately. With the assumption of circular rotation in the Galactic disk, the rotation curve and Oort's constants were derived.
Author
Asymptotic Giant Branch Stars; Carbon Stars; Mira Variables

20000029584 National Optical Astronomy Observatories, Tucson, AZ USA
A Survey for Enhanced Lithium in 261 Globular Cluster Giants
Polachowski, Catherine A., National Optical Astronomy Observatories, USA; Sneden, Christopher, Texas Univ., USA; Kraft, Robert P., Lick Observatory, USA; Harmer, Dianne, National Optical Astronomy Observatories, USA; Willmarth, Daryl, National Optical Astronomy Observatories, USA; March 2002; 30p; In English
Report No.(s): NOAO-Preprint-871; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A survey of 261 giants in the globular clusters M3, M13, M15, and M92 carried out with the Hydra Multi-object Spectrograph on the 3.5-m WIYN Telescope has identified no stars with Li I 6707 A resonance lines stronger than 20 mA . The limiting equivalent widths of the lithium line provide upper limits of log in(Li) less than +0.0 at T(sub eff) = 4500 K and log in(Li) less than +1.0 at T(eff) = 5000 K. The absence of lithium-rich stars in the sample suggests that the percentage of giants exhibiting enhanced lithium abundances in globular clusters is low.
Author
Surveys; Lithium; Giant Stars; Globular Clusters; Metallic Stars

20000030679 NASA Goddard Space Flight Center, Greenbelt, MD USA
Winds From Luminous Late-Type Stars, 1, The Effects of Nonlinear Alfven Waves
Airapetian, V. S., Computer Sciences Corp., USA; Ofman, L., Raytheon Co., USA; Robinson, R. D., Catholic Univ. of America, USA; Carpenter, K., NASA Goddard Space Flight Center, USA; Davila, J., NASA Goddard Space Flight Center, USA; Astrophysical Journal; Jan. 10, 2000; Volume 528, pp. 965-971; In English
Contract(s)/Grant(s): NASw-98004; Copyright; Avail: Issuing Activity

We present the results of magnetohydrodynamic (MHD) modeling of winds from luminous late-type stars using a 2.5-dimensional, nonlinear MHD computer code. We assume that the wind is generated within an initially hydrostatic atmosphere and is driven by torsional Alfven waves generated at the stellar surface. Two cases of atmospheric topology are considered: case I has longitudinally uniform density distribution and isotropic radial magnetic field over the stellar surface, and case II has an isotropic, radial magnetic field with a transverse density gradient, which we refer to as an "atmospheric hole." We use the same set of boundary conditions for both models. The calculations are designed to model a cool luminous star, for which we assume an initial hydrostatic pressure scale height of 0.072 Stellar Radius, an Alfven wave speed of 92 km/s at the surface, and a wave period of 76 days, which roughly corresponds with the convective turnover time. For case I the calculations produce a wind with terminal velocity of about 22 km/s and a mass loss rate comparable to the expected value of 10(exp -6) Solar Mass/yr. For case II we predict a two-component wind: a fast (25 km/s) and relatively dense wind outside of the atmospheric hole and a slow (1.5 km/s), rarefied wind inside of the hole.
Author
Late Stars; Magnetohydrodynamic Waves; Magnetohydrodynamics; Stellar Models; Supergiant Stars; Terminal Velocity; Stellar Winds

20000030684 Georgia Univ., Dept. of Physics and Astronomy, Athens, GA USA
Model Atmospheres for Novae in Outburst: Summary of Research ***Final Report, 1 Oct. 1996 - 30 Sep. 1999***
Hauschildt, Peter H., Georgia Univ., USA; 1999; 10p; In English
Contract(s)/Grant(s): NAG5-3618; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper presents a final report and summary of research on Model Atmospheres for Novae in Outburst. Some of the topics include: 1) Detailed NLTE (non-local thermodynamic equilibrium) Model Atmospheres for Novae during Outburst: II. Modeling optical and ultraviolet observations of Nova LMC 1988 #1; 2) A Non-LTE Line-Blanketed Stellar Atmosphere Model of the Early B Giant epsilon CMa; 3) Spectroscopy of Low Metallicity Stellar atmospheres; 4) Infrared Colors at the Stellar/Substellar Boundary; 5) On the abundance of Lithium in T CrB; 6) Numerical Solution of the Expanding Stellar Atmosphere Problem; and 7) The NextGen Model Atmosphere grid for 3000 less than or equal to T (sub eff) less than or equal to 10000K.
CASI
Novae; Atmospheric Models; Stellar Atmospheres; Extraterrestrial Radiation

20000030694 National Optical Astronomy Observatories, Tucson, AZ USA

Radial Velocities of Giant Stars in Globular Clusters

Soderbert, A. M., National Optical Astronomy Observatories, USA; Pilachowski, C. A., National Optical Astronomy Observatories, USA; Barden, S. C., National Optical Astronomy Observatories, USA; Willmarth, D., National Optical Astronomy Observatories, USA; Sneden, C., McDonald Observatory, USA; July 1999; 42p; In English
Report No.(s): NOAO-PREPRINT-845; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We report radial velocities for 303 giant stars in the globular clusters M31 M13, M15, and M92. Spectra were obtained using the 4-m Mayall and 3.5-m WIYN telescopes and the Hydra fiber positioner between 1993 and 1997; most spectra were provided by the NOAO WIYN Queue Program. Observations spanned times from a few days to several months. The uncertainties in the velocity measurements are typically 1 km/ s or less. Several stars show velocity variations which may result from binary companions or atmospheric motions. Mean cluster velocities were measured to be -147.0 +/- 0.3, -245.5 +/- 1.0, -106.2 +/- 0.3, and -120.3 +/- 0.3 km/ s, for M3, M13, M15, and M92, respectively. Radial velocity observations for the photometric variable V73 (vZ 1406) in M3 confirm that the star varies with a period of 0.67d.
Author

Radial Velocity; Globular Clusters; Spectrum Analysis

20000030726 Nobeyama Radio Observatory, Nobeyama, Japan

CO (J=1-0) Observations of the cD Galaxy of AWM7: Constraints on the Evaporation of Molecular Gas

Fujita, Yutaka, Osaka Univ., Japan; Tosaki, Tomokaaa, Gunma Astronomical Observatory, Japan; Nakamichi, Akika, Gunma Astronomical Observatory, Japan; Kuno, Nario, Nobeyama Radio Observatory, Japan; 1999; ISSN 0911-5501; 8p; In English
Report No.(s): NRO-510; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We have searched for molecular gas in the cD galaxy of a poor cluster of galaxies AWM7 using Nobeyama 45 in telescope. We do not detect CO emission in the galaxy. Our limit of molecular gas in the inner 7.5 kpc is M (sub H2) less than 4 x 10 (exp 8) M (circle dot). We estimate the total mass of molecular gas left in the cD galaxy when the gas deposited by a cooling flow once becomes molecular gas and the molecular gas is continuously evaporated by the ambient hot gas. The observational limit of molecular gas requires f greater than or approx. 10 (exp -3), where f is the ratio of the heat conduction rate to that of Spitzer. However, this contradicts recent X-ray observations showing f less than 10 (exp -5). Thus, the non-detection of CO cannot be explained by the evaporation and most of the cooled gas predicted by a cooling flow model may not change into molecular gas in the cD galaxy. Moreover, we estimate the evaporation time of molecular clouds brought to a cD galaxy through the capture of gas-rich galaxies and find that these clouds should not be evaporated if less than or approx. 10 (exp -4). Therefore, the non-detection of CO in a cD galaxy could constrain the total mass of the molecular clouds brought into it.
Author

Galactic Clusters; Molecular Gases; Evaporation; Elliptical Galaxies; Space Observations (From Earth)

20000030727 Nobeyama Radio Observatory, Nobeyama, Japan

Millimeter Continuum Observations of Parent Comets of Meteor Storms

Hasegawa, Hitoshi, ASTEC, Inc., Japan; Ukita, Nobuharu, Nobeyama Radio Observatory, Japan; Matsuo, Hiroshi, Nobeyama Radio Observatory, Japan; Kuno, Nario, Nobeyama Radio Observatory, Japan; Saitoh, Tomoki, Nobeyama Radio Observatory, Japan; Sekiguchi, Tomohiko, Graduate Univ. for Advanced Studies, Japan; Fuse, Tetsuharu, Graduate Univ. for Advanced Studies, Japan; Nakamura, Ryosuke, Kobe Univ., Japan; Yokogawa, Sozo, Tokyo Univ., Japan; 1999; ISSN 0911-5501; 6p; In English
Report No.(s): NRO-507; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The 2 millimeter continuum observations of parent comets of meter storms, P/Tempel-Tuttle and P/Giacobini-Zinner, were made with a bolometer array installed on the 45m radio telescope at the Nobeyama Radio Observatory. P/Tempel-Tuttle was observed on January 16 1998, near its closest approach to the earth, and P/Giacobim-Zinner was observed November 5 and 8 1998. The maps obtained showed no signal from these comets greater than 12.0 mJy for P/Tempel-Tuttle and 17.4 mJy for P/Giacobini-Zinner (3 sigma). Using the same assumptions, we estimated that, the mass upper limits in the 12 arcsec beam were 7.5 x 10 (exp 9) kg and 6.2 x 10 (exp 10) kg for P/Tempel-Tuttle and P/Giacobini-Zinner respectively.
Author

Comets; Continuums; Millimeter Waves; Meteoroids

20000031368 NASA Goddard Space Flight Center, Greenbelt, MD USA

So We've Lost the Mission?

Mather, John C., NASA Goddard Space Flight Center, USA; [1999]; 14p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper describes The Cosmic Background Explorer Satellite Mission that was lost. It also describes the author's experiences as a youth, his college years, and employment with NASA.

CASI

Cosmic Background Explorer Satellite; Big Bang Cosmology; Background Radiation

20000031408 Nobeyama Radio Observatory, Nobeyama, Japan

Stellar Velocity Field in the Galactic Bar

Deguchi, S., Nobeyama Radio Observatory, Japan; 1999; ISSN 0911-5501; 14p; In English; Toward a New Millennium in Galaxy Morphology, 13-18 Sep. 1999, Johannesburg, South Africa

Report No.(s): NRO-506; Copyright; Avail: Issuing Activity

A survey has been made in the SiO J =1-0, v =1 and 2 transitions (approx. 43 GHz) for the color-selected IRAS (Infrared Astronomy Satellite) sources in the central part of the Galaxy, -10 deg. less than l less than 40 deg. and absolute value of b less than or equal to 3 deg. with the Nobeyama 45-m telescope. We have detected 338 out of 622 observed sources in SiO masers. Distances to the sources range approximately from 2 kpc to 13 kpc (estimated from the IRAS 12 and 25 micrometer flux densities). Radial velocities of the detected sources spread between -310 km per second and 300 km per second. The subsets of sources in -10 deg., less than l less than 15 deg, which are divided by distance exhibit a systematic velocity shift with distance, suggesting evidence of noncircular motions of stars along the bulge bar.

Author

Radial Velocity; Galaxies; Galactic Structure; Star Distribution; Velocity Distribution

20000031470 Lunar and Planetary Inst., Houston, TX USA

Slow Impact Vapor Plume Expansion with Realistic Equations of State

Melosh, H. J., Lunar and Planetary Inst., USA; Pierazzo, E., Lunar and Planetary Inst., USA; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 35; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

When a meteorite strikes a planetary surface at speeds greater than a few kilometers per second, the kinetic energy of the meteorite is partially converted into heat by irreversible processes. The meteorite and some target material may vaporize after release from high pressure. In the past, a model of vapor-plume expansion based on the expansion of a spherical cloud with a perfect gas equation of state was used to model the expansion of these vaporized gases. A comparison between this model and detailed numerical calculations of the Chicxulub impact shows that the vapor plume in the more realistic numerical model takes far longer than predicted to accelerate out of the crater (more than 30 s, compared to a predicted time of a few seconds). We verified this delayed expansion for an impact of an Al projectile onto an Al target to check that problems of chemical speciation in the vapor plume were not affecting our results. Based on the study of several such computations, we propose that this long delay is due to a combination of the liquid-vapor phase transition in the realistic (ANEOS) equation of state used in this simulation and the nonspherical geometry of the expanding projectile. to examine these effects on plume expansion, we employed a highly simplified equation of state (the Van da Waals equation) that nevertheless exhibits a liquid-vapor phase transition. Using a one-dimensional Lagrangian hydrocode, we investigated the qualitative effect of the phase transition on vapor plume expansion and demonstrated that the expansion is affected by (1) a rapid decompression (compared to a perfect gas) that cools the supercritical rock vapor until it reaches the phase boundary, followed by (2) a very slow phase of acceleration fueled mainly by the latent heat of the two-phase mixture. This slow acceleration occurs mainly because of the extremely low sound speed in the two-phase liquid-vapor system. The final velocity for the realistic equation of state and a perfect gas of the same initial internal energy is nearly the same, but it takes much longer to achieve this velocity with a realistic equation of state. In addition, studies of the expansion of cylinders and planes of hot gas show that the expansion is greatly affected by the geometry of the initial gas cloud. Since an impacting projectile is quickly distorted from its initial spherical shape to a pancake shape lining the growing crater cavity, geometric effects may also strongly affect the expansion rate. Current numerical simulations of impacts do not extend to late enough times to capture correctly the dynamics of this plume expansion; as a result, these simulations greatly underestimate the amount and velocity of ejected debris. This very slow plume expansion may also affect the final phases of melt deposition on top of the crater, leading to a normally graded, apparently air-fall type of deposit consisting of melted rock droplets.

Author

Meteorites; Plumes; Vapors; Meteorite Craters; Cratering; Ejecta; Projectile Cratering; Hypervelocity Impact

20000031632 California Inst. of Tech., Caltech Submillimeter Observatory, Pasadena, CA USA

Probing the Magnetic Field with Molecular Ion Spectra, *2000-2001*

Houde, M., California Inst. of Tech., USA; Bastien, Pierre, Montreal Univ., Canada; Peng, Ruisheng, California Inst. of Tech., USA; Phillips, Thomas G., California Inst. of Tech., USA; 2000; 18p; In English

Contract(s)/Grant(s): NSF AST-96-15025; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Observations of the effect of the magnetic field on its environment are usually achieved with techniques which rely on the interaction with the spin of the particles under study. Because of the relative weakness of this effect, extraction of the field characteristics proves to be a most challenging task. We take a totally different approach to the problem and show that the manifestation of the magnetic field can be directly observed by means of a comparison of the spectra of molecular ions with those of neutral molecules. This takes advantage of the strong cyclotron interaction between the ions and the field, but requires the presence of flows or turbulent motion in the gas. We compare our theory to data obtained on the OMC1, OMC2, OMC3 and DR21OH molecular clouds.

Author

Magnetic Effects; Magnetic Fields; Molecular Ions; Molecular Spectra; Star Formation; Molecular Clouds

20000031633 California Inst. of Tech., Caltech Submillimeter Observatory, Pasadena, CA USA

Atomic Carbon in Galaxies, *2000-2002*

Gerin, M., Centre National de la Recherche Scientifique, France; Phillips, T. G., California Inst. of Tech., USA; [2000]; 36p; In English; Sponsored in part from INSU

Contract(s)/Grant(s): NSF AST-96-15025; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present new measurements of the ground state fine-structure line of atomic carbon at 492 GHz in a variety of nearby external galaxies, ranging from spiral to irregular, interacting and merging types. In comparison with CO(1-0) emission observed at the same spatial resolution, the CI(1-0) line intensity stays fairly comparable in the different environments, with an average value of the ratio of the line integrated areas in Kkm/s of CI(1-0)/CO(1-0) = 0.2 +/- 0.2. However, some variations can be found within galaxies, or between galaxies. Relative to CO lines (J=2-1, 3-2, 4-3), CI(I-0) is weaker in galactic nuclei, but stronger in disks, particularly outside star forming regions. Also, in NGC 891, the CI(1-0) emission follows the dust continuum emission at 1.3mm extremely well along the full length of the major axis where molecular gas is more abundant than atomic gas. Atomic carbon therefore appears to be a good tracer of molecular gas in external galaxies, possibly more reliable than CO. Atomic carbon can contribute significantly to the thermal budget of interstellar gas. The cooling due to C and CO are of the same order of magnitude for most galaxies. However, CO is generally a more important coolant in starburst galaxies. Cooling due to C and CO amounts typically to 2 x 10(exp -5) of the FIR continuum or 5% of the CII line. However, C and CO cooling reaches approximately 30% of the gas total, in Ultra Luminous InfraRed Galaxies (ULIRG) like Arp 220, where CII is abnormally faint. Together with CII/FIR, the emissivity ratio CI(1-0)/FIR can be used as a measure of the non-ionizing UV radiation field in galaxies. The plots of CII/CI or CII/FIR versus CI/FIR show good correlations, in agreement with PDR models, except for two remarkable galaxies Arp 220 and Mrk 231, where high opacities of the CII line and possibly the dust thermal emission may be factors reducing the CII strength below the predictions of the current PDR models.

Author

Cosmic Gases; Interstellar Gas; Molecular Gases; Monatomic Gases; Fine Structure; Starburst Galaxies; Galactic Nuclei; Disk Galaxies

20000031687 Academia Sinica, Yunnan Observatory, Kunming, China

The Observation Properties of Radio-Selected BL Lac Objects (RBLs)

Fan, Jun-Hui, Guangzhou Normal Univ., China; Lin, Rui-Guang, Guangzhou Normal Univ., China; Publications of the Yunnan Observatory; 1996; ISSN 1001-7526, No. 4, pp. 8-20; In English; Sponsored in part by National Natural Foundation of Guangdong Province; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this paper, the observed data have been compiled and some properties have been discussed for a completed sample of radio selected BL Lac objects(RBLs).

Author

BL Lacertae Objects; Radio Observation; Galaxies

20000031688 Academia Sinica, Yunnan Observatory, Kunming, China

The First-Order Kohmoto Entropy of the Large Scale Structure of the Universe

Huan, Zun-Xiang, Academia Sinica, China; Cao, Wen-Da, Academia Sinica, China; Song, Qi-An, Academia Sinica, China; Ji, Kai-Fan, Academia Sinica, China; Publications of the Yunnan Observatory; 1996; ISSN 1001-7526, No. 4, pp. 1-7; In Chinese; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The observed evidences have shown that the distribution of the large scale structure of the universe is self similar or self affine, and the fractal dimensions of these two kinds of distributions have been obtained. Kohmoto entropy pointed out in multifractals has established the form analogy between the multifractals and thermodynamics. In a three dimension spherical system of coordinates, we calculate the first order Kohmoto entropy of the large structure of the universe which has the self similar fractal distribution in the region r(sub 0)

Author

Large Space Structures; Entropy; Universe; Cosmology

20000031721 NASA Goddard Space Flight Center, Greenbelt, MD USA

The Formation Age of Comets: Predicted Physical and Chemical Trends

Nuth, Joseph A., III, NASA Goddard Space Flight Center, USA; Hill, Hugh G. M., NASA Goddard Space Flight Center, USA; [2000]; 4p; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Dust grains in Herbig Ae/Be stars are continuously replenished by infalling comets. The IR spectra of these cometary grains appear to evolve temporally from initially amorphous astronomical silicates in young protostars to crystalline olivine in much older sources. Crystalline olivine can only be produced from amorphous silicates on a time scale of months-to-years via thermal annealing at temperatures near 1000 K. Since such sustained high temperatures only occur near the central star, dust annealed at 1000 K in inner nebular regions must be continuously transported beyond the nebular snowline to be incorporated into the next generation of cometesimals. The average formation age of a comet can therefore be measured as a ratio of the annealed crystalline olivine dust component to the total dust content of the comet. Comets formed from nearly pristine interstellar materials early in the protostellar nebula stage will contain very little crystalline dust whereas comets formed towards the end of the accretion period will incorporate a much higher percentage of annealed silicate. It is unlikely that only dust grains circulate from the inner to the outer nebula; the gas associated with such dust should also find its way beyond the snowline. Since this gas and dust will have equilibrated in the higher pressure-temperature regime of the inner nebula, it will contain a much higher proportion of hydrocarbons and ammonia than more pristine interstellar ices. Therefore, in addition to a higher fraction of crystalline dust, later forming comets should also contain higher ratios of hydrocarbons to CO and ammonia to N2 than do those formed early in the history of the nebula.

Author

Comets; Chemical Composition; Trends; Star Formation

20000031760 Academia Sinica, Yunnan Observatory, Kunming, China

The Improvement of Determination of the Instantaneous Azimuth Error of Lower Latitude Meridian Circle (LLMC)

Peng, Qing-Yu, Academia Sinica, China; Publications of the Yunnan Observatory; 1996; ISSN 1001-7526, No. 4, pp. 50-54; In Chinese; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

By using the zenith distances of a pair of stars which have the almost same declinations and are observed at the almost same moment in the east and west of the prime vertical, the instantaneous azimuth error of the instrument can be determined absolutely. In comparison with the original method, there is no superposition of the variation of the azimuth error in the present method and the original design of the instrument is not needed to be changed. Therefore, the observational system of LLMC is expected to be improved.

Author

Azimuth; Circles (Geometry); Instrument Errors

20000031761 Academia Sinica, Yunnan Observatory, Kunming, China

The Maintenance of the Orientation of IERS Celestial Reference Frames from 1988 to 1995

Li, Jin-Ling, Shanghai Observatory, China; Jin, Wen-Jing, Shanghai Observatory, China; Publications of the Yunnan Observatory; 1996; ISSN 1001-7526, No. 4, pp. 43-49; In Chinese; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The maintenance of orientation of the International Earth Rotation Service (IERS) celestial reference frames from 1992 to 1995 are analyzed in this paper. In combination with the maintenance for years from 1988 to 1992, it is concluded that there are detectable variations in the orientation of IERS celestial reference frames from 1988 to 1995. The biggest shifts of the origin of

right ascension and of the celestial pole are about 0.4 mas. Till 1995, the deviations of the origin of right ascension and the celestial pole from their originally expected positions are no less than 0.4 mas. The orientation of the 1993's IERS frame was maintained by the 1994 and 1995 IERS frames at a precision of 0.05 mas rather than 0.005 mas. The precision of 0.005 mas is a result of mathematical mean. The coordinate differences of a considerable number of primary (or defining) sources in successive IERS frames are bigger than 0.5 mas, which demonstrates that the orientation of the celestial reference frames can be maintained in a relatively high precision if a suitable method for identifying or removing the local relative deformations between individual frames was adopted.
Author
Maintenance; Earth Rotation; Celestial Reference Systems; Earth Orientation

20000032017 Communications Research Lab., Tokyo, Japan
Near-Miss of Asteroids: Collision with the Earth?
Yoshikawa, Makoto, Communications Research Lab., Japan; Review of the Communications Research Laboratory; Dec. 1993; ISSN 0914-9279; Volume 39, No. 4, pp. 261-273; In Japanese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

At present, the orbital elements of more than 5,500 asteroids have been determined, and this number is increasing as fainter asteroids are discovered. Moreover, recently we have observed some asteroids that have approached to the earth very closely. As a result the possibility of asteroids colliding with the earth should be considered. In this paper, first the distribution and the motion of asteroids are summarized, and it is shown that the features of distribution are closely related to the dynamical properties of the asteroids. Then, the results of analysis of the near-miss phenomena are discussed. In this analysis, we calculated the orbital motions of 4,506 numbered asteroids, taking into account the effect of the gravitational attraction between asteroids as well as the perturbation of nine planets. The calculation was carried out for a period of about 130 years into the future, and close encounters between the earth and asteroids of less than 0.2 AU were monitored. Using this calculation, we found that many asteroids will come close to the earth, but there is no possibility of collision. Therefore, there is no need to worry about the earth colliding with known asteroids at present. However, there are many unknown asteroids, so we should extend our observations in order to discover them.
Author
Asteroids; Asteroid Collisions

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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.

20000027670 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
MGS images of Mars
Jun. 23, 1999; In English; Videotape: 4 min. 21 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000033901; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS

The Mars Global Surveyor (MGS) camera captured images of a pit formed when a straight-walled trough collapsed. The heart shaped pit is about 2.3 kilometers (1.4 miles) wide. It is located on the east flank of the Alba Patera volcano in northern Tharsis.
CASI
Mars Global Surveyor; Mars Photographs; Mars Surface; Troughs

20000027672 Pennsylvania State Univ., Dept. of Astronomy and Astrophysics, University Park, PA USA
A Detailed Investigation into the Use of Planetary Nebulae as Standard Candles ***Final Report, 15 Sep. 1996 - 14 Sep. 1998***
Ciardullo, Robin, Pennsylvania State Univ., USA; Jan. 19, 2000; 4p; In English
Contract(s)/Grant(s): NAG5-3403; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The program's goal was to understand the physics underlying the [O III] (lambda)5007 planetary nebula luminosity function (PNLF) and evaluate its accuracy as an extragalactic distance indicator. Work under the grant concentrated in two areas. The first major goal was to extensively test the PNLF method to find its limits. We did this performing yet another internal test of the method in the core galaxies of the Fornax Cluster, performing external comparisons of PNLF distances with distances derived from Cepheids and the Surface Brightness Fluctuation method (SBF), and, in general, examining the PNLF in as many different galactic environments as possible, including the disks of late-type spirals. Because of the difficulty distinguishing planetary nebulae (PNe) from H II regions, and because spiral galaxies have uneven internal extinction, the process of identifying "statistical" samples of

PNe in these objects is extremely complicated. Nevertheless, by using the ratio of [O III] (lambda)5007 to H(alpha) as a diagnostic, we were able to effectively discriminate PNe from most H II regions, and apply the method to systems such as NGC 300, M101, M51, and M96. The second goal of this research was to determine theoretically, why the PNLF is such an excellent standard candle. Derived from text

Research; Planetary Nebulae; Luminosity; H II Regions; Brightness

20000027707 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Mars Global Surveyor MOC Images

Jul. 09, 1999; In English; Videotape: 3 min. 10 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2000033902; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS

Images of several dust devils were captured by the Mars Orbiter Camera (MOC) during its global geodesy campaign. The images shown were taken two days apart, May 13, 1999 and May 15, 1999. Dust devils are columnar vortices of wind that move across the landscape and pick up dust. They look like mini tornadoes.

CASI

Images; Mars Global Surveyor; Dust

20000027711 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Mars Global Surveyor Images

Jun. 29, 1999; In English; Videotape: 2 min. 26 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2000033899; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS

High resolution images that help scientists fine tune the landing site for NASA's Mars Surveyor lander mission are shown. These images reveal a smooth surface in the southern cratered highlands near the Nepenthes Mensae.

CASI

Mars Global Surveyor; Images

20000027712 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Mars Images MOC2-106 through 109

Apr. 07, 1999; In English; Videotape: 3 min. 12 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2000033898; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS

Mars Global Surveyor images of the following are shown: Margin of lava flow in Daedalia Planum; Ripples in cratered terrain north of Hesperia Planum; Martian variety exhibited by the Olympica Fossae; and East Tithonium chasma wall, Valles Marineris.

CASI

Mars Global Surveyor; Images; Mars Surface; Craters; Mars (Planet)

20000028287 Arizona State Univ., Dept. of Geology, Tempe, AZ USA

Geologic Studies in Support of Manned Martian Exploration

Frix, Perry, Arizona State Univ., USA; McCloskey, Katherine, Arizona State Univ., USA; Neakrase, Lynn D. V., Arizona State Univ., USA; Second Annual HEDS-UP Forum; 1999, pp. 17-33; In English; See also 20000028286; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

With the advent of the space exploration of the middle part of this century, Mars has become a tangible target for manned space flight missions in the upcoming decades. The goals of Mars exploration focus mainly on the presence of water and the geologic features associated with it. to explore the feasibility of a manned mission, a field analog project was conducted. The project began by examining a series of aerial photographs representing ”descent” space craft images. From the photographs, local and regional geology of the two ”landing” sites was determined and several ”targets of interest” were chosen. The targets were prioritized based on relevance to achieving the goals of the project and Mars exploration. Traverses to each target, as well as measurements and sample collections were . planned, and a timeline for the exercise was created. From this it was found that for any mission to be successful, a balance must be discovered between keeping to the planned timeline schedule, and impromptu revision of the mission to allow for conflicts, problems and other adjustments necessary due to greater information gathered upon arrival at the landing site. At the conclusion of the field exercise, it was determined that a valuable resource for mission planning is high resolution remote sensing of the landing area. This led us to conduct a study to determine C CD t~ what ranges of resolution are necessary to observe geology features important to achieving the goals of Mars exploration. The procedure used involved degrading a set of images to differing resolutions, which were then examined to determine what features could be seen and interpreted. The features were rated for recognizability, the results were tabulated, and a minimum necessary resolution was determined. Our study found that for the streams, boulders, bedrock, and volcanic features that we observed, a resolution of at

least I meter/pixel is necessary. We note though that this resolution depends on the size of the feature being observed, and thus for Mars the resolution may be lower due to the larger size of some features. With this new information, we then examined the highest resolution images taken to date by the Mars Orbital Camera on board the Mars Global Surveyor, and planned a manned mission. We chose our site keeping in mind the goals for Mars exploration, then determined the local and regional geology of the ”landing area. Prioritization was then done on the geologic features seen and traverses were planned to various ”targets of interest”. A schedule for each traverse stop, including what measurements and samples were to be taken, and a timeline for the mission was then created with ample time allowed for revisions of plans, new discoveries, and possible complications.
Author
Mars (Planet); Mars Exploration; Mission Planning; Mars Missions; Simulation; Manned Mars Missions; Mars Landing

20000028291 Metropolitan State Coll., Denver, CO USA
MADEX: Martian Drilling and Exploration
Cox, Ryan, Metropolitan State Coll., USA; Addante, John, Metropolitan State Coll., USA; Anderson, Don, Metropolitan State Coll., USA; Bacon, Dudley, Metropolitan State Coll., USA; Bacon, Sam, Metropolitan State Coll., USA; Barkovich, Shara, Metropolitan State Coll., USA; Bowman, Jeff, Metropolitan State Coll., USA; Christianson, Andrew, Metropolitan State Coll., USA; Dorrier, Jason, Metropolitan State Coll., USA; Gallegos, Danielle, Metropolitan State Coll., USA; Second Annual HEDS-UP Forum; 1999, pp. 97-112; In English; See also 20000028286; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The concept will take samples and spectrometer data at various depths below the Martian surface. The unit will address three major objectives for the human exploration of Mars. 1) Can humans ultimately inhabit Mars? 2) Is there or has there been life on Mars? 3) What is the history of the Martian planet? Rather than drilling vertically from the surface of the planet and taking samples at predetermined depths, the Martian Drilling and Exploration Unit (MADEX), will be lowered over a cliff to drill horizontally at various depths. The unit will attempt to satisfy the objectives using spectroscopic data taken along the cliff wall and analysis of the core samples taken.
Author
Core Sampling; Mars (Planet); Mars Surface; Water; Mars Exploration; Roving Vehicles; Research Vehicles; Drilling

20000028296 University of Southern California, Dept. of Aerospace Engineering, Los Angeles, CA USA
The Exploration of Mars: Crew Surface Activities
Bhosri, Wisuwat, University of Southern California, USA; Cojanis, Philip, University of Southern California, USA; Gupta, Madhu, University of Southern California, USA; Khopkar, Manasi, University of Southern California, USA; Kiely, Aaron, University of Southern California, USA; Myers, Michael, University of Southern California, USA; Oxnevad, Knut, University of Southern California, USA; Sengupta, Anita, University of Southern California, USA; Sexton, Adam, University of Southern California, USA; Shaw, Don, University of Southern California, USA; Second Annual HEDS-UP Forum; 1999, pp. 181-199; In English; See also 20000028286; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Surface activities of the first Mars mission crew, as suggested in phase I of the NASA HEDS reference mission, are discussed in this paper. The HEDS reference mission calls for a two phased approach. In phase I, humans supported by robotic systems will explore the Martian surface, collect and analyze geologic, geophysical, and meteorological data, search for potential permanent base sites, and conduct technology verification experiments. In phase II, a Mars base site will be selected, and the building of a permanent human base will be initiated. In this report two complementary architectures are portrayed. First, a permanent base for 3-6 people consisting of an ISRU unit, two nuclear power systems, a green house, and inflatable habitats and laboratories, built inside adobe structures. Second, a reusable, and resupplyable methane propelled very long range type traverse vehicle capable of collecting and analyzing data, and repairing and deploying scientific payloads during its planned 150 days 4800 km traverse. The very long range traverse vehicle will carry smaller rovers, crawlers, blimps, and an air drill capable of quickly reaching depths beyond 100m. The report presents a global vision of human activities on the surface of Mars at a programmatic level. It consists of several vignettes called ”concept architectures” We speculate that these activities will facilitate a phase I Mars exploration architecture.
Author
Mars Exploration; Mars Missions; Roving Vehicles; Spacecrews; Mission Planning

20000030741 NASA Ames Research Center, Moffett Field, CA USA

Seasonal Water Transport in the Atmosphere of Mars: Applications of a Mars General Circulation Model Using Mars Global Surveyor Data ***Final Report, 1 Jul. 1997 - 30 Nov. 1999***

Hollingsworth, Jeffery L., San Jose State Univ., USA; Bridger, Alison F. C., San Jose State Univ., USA; Haberle, Robert M., NASA Ames Research Center, USA; [1999]; 26p; In English; Original contains color illustrations

Contract(s)/Grant(s): NCC2-5230; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This is a Final Report for a Joint Research Interchange (JRI) between NASA Ames Research Center and San Jose State University, Department of Meteorology. We present below a summary of progress made during the duration of this JRI. The focus of this JRI has been to investigate seasonal water vapor transport in the atmosphere of Mars and its effects on the planet's present climate. to this end, the primary task has been to adapt a new dynamical processor for the adiabatic tendencies of the atmospheric circulation into the NASA Ames Mars general circulation model (MGCM). Using identical boundary and initial conditions, several comparative tests between the new and old MGCMs have been performed and the nature of the simulated circulations have been diagnosed. With confidence that the updated version of the Ames MGCM produces quite similar mean and eddy circulation statistics, the new climate model is well poised as a tool to pursue fundamental questions related to the spatial and seasonal variations of atmospheric water vapor on Mars, and to explore exchanges of water with non-atmospheric reservoirs and transport within its atmosphere. In particular, the role of surface sources and sinks can be explored, the range of water-vapor saturation altitudes can be investigated, and plausible precipitation mechanisms can be studied, for a range of atmospheric dust loadings, such future investigations can contribute to a comprehensive study of surface inventories, exchange mechanisms, and the relative importance of atmospheric transport Mars' water cycle. A listing of presentations made and manuscripts submitted during the course of this project is provided.

Author

Mars Atmosphere; Atmospheric General Circulation Models; Annual Variations; Mars Global Surveyor; Mars Surface; Water Vapor

20000031463 Lunar and Planetary Inst., Houston, TX USA

Cratering on Titan: A Pre-Cassini Perspective

Lorenz, R. D., Lunar and Planetary Inst., USA; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 31; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The NASA-ESA Cassini mission, comprising a formidably instrumented orbiter and parachute-borne probe to be launched this October, promises to reveal a crater population on Titan that has been heretofore hidden by atmospheric haze. This population on the largest remaining unexplored surface in the solar system will be invaluable in comparative planetological studies, since it introduces evidence of the atmospheric effects of cratering on an icy satellite. Here, I highlight some impact features we may hope to find and could devote some modeling effort toward. Titan in a Nutshell: Radius= 2575 km. Density= 1880 kg/cubic m consistent with rock-ice composition. Surface pressure = 1.5 bar. Surface gravity = 1.35 m/square s Atmosphere -94% N2 6% CH, Surface temperature = 94K Tropopause temperature = 70K at 40 km alt. Probable liquid hydrocarbon deposits exist on or near the surface.Titan in a Nutshell: Radius= 2575 km. Density= 1880 kg/cubic m consistent with rock-ice composition. Surface pressure = 1.5 bar. Surface gravity = 1.35 m/square s; Atmosphere about 94% N2 6% CH, Surface temperature = 94K Tropopause temperature = 70K at 40 km alt. Probable liquid hydrocarbon deposits exist on or near the surface. Titan is comparable to Callisto and Ganymede for strength/gravity, Mars/Earth/Venus for atmospheric interaction, and Hyperion, Rhea, and Iapetus for impactor distribution. The leading/trailing asymmetry of crater density from heliocentric impactors is expected to be about 5-6, in the absence of resurfacing. Any Saturnocentric impactor population is likely to alter this. In particular the impact disruption of Hyperion is noted; because of the 3:4 orbital resonance with Titan, fragments from the proto-Hyperion breakup would have rapidly accreted onto Titan. Titan's resurfacing history is of course unknown. The disruption of impactors into fragments that individually create small craters is expected to occur. A crude estimate suggests a maximum separation of about 2 km (compared with 4 km on Venus, or 0.5 km on Earth). Crater chains are unlikely on Titan, since impactors must pass close enough to Saturn to be tidally disrupted; as a result, they would suffer aerodynamic disruption. Crater counting on adjacent satellites gives densities of about 200 per 10 (exp 6) square km for 20-km-diameter craters. However, the presence of a thick atmosphere leads to atmospheric shielding, depleting the relative abundance of small craters. This has been evaluated by models, and the relative abundance of small craters may be due to a diagnostic atmospheric collapse. A number of radar-dark "splotches" have been detected on Venus; these have been attributed to the interaction of the surface with the atmospheric shockwave produced by the Tunguska-like explosion of a bolide in the atmosphere. Simple analogy suggests that similar features might occur on Titan, but the shocked mass density (which controls the momentum coupling between the surface and the shockwave) of Titan's cold N2 atmosphere is about 20x smaller than that of Venus's hot CO2 atmosphere. Unless ice is much more easily turned to rubble than is rock, such features seem less probable on Titan. When the energy deposited by an impact forms a fireball with an equilibrate greater than one scale

height, the fireball expands upward and can distribute ejecta. on ballistic exoatmospheric trajectories. On Venus this process is believed to be responsible for the parabolic features; the interaction of various-sized particles falling through the atmosphere with the zonal wind field winnows the particles to form a parabolic deposit. Although such a process is possible on Titan, the large scale height at higher altitudes would make it more difficult. Comparison with craters on other icy satellites suggests that craters on Titan will be fairly shallow (depth/diameter about 0.1) and craters greater than 10 km in diameter will have central peaks or domed bases, perhaps with central pits. The formation of ejecta. blankets may involve the atmosphere in a significant way, both by restraining the expansion of the ejecta cloud and by influencing the thermal history of the ejecta. Compared with Venus, Titan's atmosphere will chill an impact melt somewhat quickly, so the long ejecta flows seen on Venus seem less likely, detailed modeling needs to be performed to determine the impact melt production. Crater topography on Titan may be highlighted by the influence of liquids forming crater lakes. Craters with central peaks will typically form ring-shaped lakes, although horseshoe-shaped takes may be common; domed craters with central pits may even form bullseye lakes with islands with central ponds. If liquids have covered a substantial part of Titan's surface for a substantial period, hydroblemes and tsunami deposits may be common.
Author
Cassini Mission; Cratering; Titan; Meteorite Craters; Meteoritic Damage; Topography

20000031497 Lunar and Planetary Inst., Houston, TX USA
Serenitatis: The Oldest, Largest Impact Basin Sampled in the Solar System
Ryder, G., Lunar and Planetary Inst., USA; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 49; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Serenitatis Basin was recognized in the early 1960s as a multiring impact basin. Poikilitic impact melt breccias collected on the Apollo 17 mission, generally inferred to be Serenitatis impact melt, precisely define its age as 3.893 +/- 0.009 Ga. On the topographic map produced from Clementine data, the basin has a well-defined, circular structure corresponding closely with mare fill. In the review by , this circular structure has a diameter of 620 km (Taurus ring). The main rim is deemed to have a diameter of 920 km (Vitruvius ring). Thus Serenitatis is both the oldest and the largest basin in the solar system to which we can confidently assign samples. The central flooded part of the Serenitatis Basin displays a mascon gravity anomaly. Gravity and topographic studies by Neumann, correcting for the mascon, indicate that the crust was thinned to about 30 km compared to a surrounding thickness of about 55 km. The rim has a slightly thickened crust. The Apollo 17 landing site lies between the Taurus and the Vitruvius rings. Remote studies show that the Taurus highlands differ in chemical composition from those around the Crisium and Nectaris Basins. They are consistently lower in alumina and higher in Fe and radioactive elements: the highlands are the noritic, rather than the anorthosite, stereotype of the ancient highlands. Tracks show that many of the poikilitic impact melt breccias rolled from high in the massifs, possibly from ledges. They vary in grain size and texture. Larger boulders display sharp contacts between texturally different units, which differ slightly big significantly in composition. They have about 18% Al2O3 and incompatible elements of about 100x chondrites. The breccias contain lithic clasts. Feldspathic granulitic breccias are the most common, but these do not form any significant component of the melt composition itself. Other lithic components are mainly plutonic igneous rocks such as norite and troctolite. Ferroan anorthosites and mare basalts are absent. Mineral fragments suggest similar but more diverse mafic lithologies. The evidence from rocks, remote sensing, and geophysics suggests that the target for the Serenitatis impact was a noritic one and consisted largely of pristine igneous mafic rocks rather than a megabreccia. As the melt moved out, it first picked up heavily comminuted mineral fragments similar to the target and later picked up larger fragments of such material. Finally, it picked up feldspathic granulitic breccias when the melt was too cool to dissolve them significantly into the melt. The melt finally came to rest in a location that, following slumping, formed the Taurus highlands.
Author
Impact Melts; Lunar Maria; Topography; Lunar Craters; Selenology; Meteorite Craters

20000031517 California Univ., Inst. of Geophysics and Planetary Physics, Los Angeles, CA USA
Large Meteoritic Impacts and Lunar Differentiation
Warren, P. H., California Univ., USA; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 62-63; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Moon is a body where meteoritic impacts have played an even more important evolutionary role than on Earth. A key issue is the role of impact as a cause of melting on a large enough scale to engender igneous differentiation. What fraction of Apollo rock samples generally viewed as "pristine" products of early endogenous magmatism are actually products of impact melt? Cold clastic debris has a strong chilling effect on impact melt. Consequently, the melting displacement ratio m/d is probably the paramount influence on the potential for an impact-generated magma to undergo internal igneous differentiation (fractional crystallization). For calibration of the relationship between m/d and the potential for impact magma igneous differentiation (MIID), we must look to large terrestrial structures with well-exposed melt sheets. IMID was evidently vastly greater at Sudbury

(m/d - 0.46) than at the two next largest such structures, Popigai and Manicouagan (both m/d - 0.24). The Sudbury IMID may have been enhanced by endogenous melting potential (deep-crustal heat) in the Penokean Sudbury region. Considering that at Manicouagan and Popigai the melt sheets did not differentiate even slightly, it seems likely that a robust IMID requires m/d is greater than 0.3. On the Moon m/d is much smaller for a given crater size than on Earth. of the known (young enough to be seen) large basins, only a few formed with m/d is greater than 0.3, m/d calculated a la Melosh. Any differentiated lunar melt sheet is probably capped by a clastic debris-rich, heterogeneous but nondifferentiated Onaping analog. Igneous differentiates (cumulates) making their way into an Apollo rock collection would require a later large crater to excavate from several km in depth, with sufficient lateral transport (anticorrelated with depth of excavation in any single event) to bring the rock into the small Apollo sampling region. Except by starting from Procellarum (or some other basin not currently visible), this series of events appears unlikely. A strong objection to the hypothesis that a single basin (Procellarum) is the source of the apparent pristine rocks is the correlation among these samples between trace-element compositions and Apollo sampling locations. The distinction between impact melt and endogenous, mantlederived melt begins to blur when extremely large events are considered. In big lunar events, impact melt that avoids immediate dissemination (ejection) is of mainly mantle derivation. For Sudbury, the same approach predicts crust/ (mantle + crust) is not is less than 100% and could well be 1. On the early Moon, big impacts probably influenced the times and places where magmas intruded the crust, but except for basins too young to have yielded samples, the heat for the magmatism was probably mainly endogenous. (Additional information is contained in the original)
Author
Hypervelocity Impact; Impact Melts; Meteorite Collisions; Lunar Craters; Selenology

20000031519 Washington Univ., Dept. of Earth and Planetary Sciences, Saint Louis, MO USA
The Structure of Lunar Basins: Implications for the Basin-Forming Process
Wiieczorek, M. A., Washington Univ., USA; Phillips, R. J., Washington Univ., USA; Large Meteorite Impacts and Planetary Evolution; 1997, pp. 63-64; In English; See also 20000031409; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Using lunar gravity and topography data obtained from the Clementine missions, a global crustal thickness map was recently generated. This model had a two-layered crust; gravity anomalies were assumed to be primarily to upper crustal thickness variations, and a spherical analog of Parker's algorithm was used in computing the potential anomalies due to finite amplitude relief along the surface, intracrustal interface and Moho. This dual-layered model of lunar crustal structure has several important properties: (1) the upper crust (about 30 km thick) was entirely removed during the formation of the major nearside basins. This is consistent with the fact that the ejecta for these basins shows a considerable noritic component, which presumably was derived from the lower crust. (2) The large South-Pole Aitken basin also had its entire upper crust removed, but has a 30-km-thick lower crust present. This basin apparently did not excavate into the lunar mantle, which is consistent with spectral reflectance studies fo the regolith. (3) Surrounding most basins is an annulus of thickened crust. This is a result of a low "gravity moat" that surrounds most multiring basins. (4) The crust below the Crisium Basin is extremely thin (about 5 km). by adjusting the parameters of the above gravity model, it is possible to get a zero total crustal thickness beneath the basin. Thus based on gravity studies, Crisium is the only basin that could possibly have excavated mantle material. In this study we use the above crustal thickness model, as well as the lunar gravity field, to study several aspects of the basin-forming process (1) what was the size of the excavation cavity? (2) How much lower crustal material was excavated? (3) Is the gravity moat surrounding the basins due to crustal thickness variations, lower density ejecta deposits, or brecciated bedrock (i.e., the "strength crater"? (4) Were the basins in isostatic equilibrium before or after the emplacement of mare basalts? Radially averaged crustal thickness profiles for the major basins all show that the upper crust is significantly thinned and the the moho is substantially uplifted beneath these basins. We use a relatively simple technique to reconstruct the size of the excavation cavity. Within the annulus of thickened crust, the Moho is "restored" to its average value outside of the basin. It is assumed that the resulting cavity is a good approximation of the excavation cavity (that portion of the preimpact crust that is ballistically ejected from the transient crater). Although this method does not take into account any basin modification effects such as stumping, nor does it restore the uplifted crater rim material to its original location, given the uncertainty in the lunar gravity field and the assumptions that went into the gravity modeling, we will assume that the excavation cavity is adequately described to the first order by this method. A table shows the diameter of the excavation cavity, D(sub ex) (which is equivalent to the diameter of the transient cavity), the depth of excavation, h(sub ex) and the volume of material that was excavated, V(sub ex). A best fit between h(sub ex) and D(sub ex) yields h(sub ex) = 0.07 D(sub ex). Although this correlation is not great (R = 0.54), the excavation depth always lies between 0.12 and 0.02 of the excavation cavity diameter, which is consistent with most previous estimates. A good correlation (R = 0.82) is found between the transient cavity diameter and the most prominent ring diameter, D, for the multiring basins, given by D(sub t) = 0.41D + 134 (most prominent ring diameter taken). This correlation is very similar to that given by Spudis. We are currently in the process of determining the pre- and postmare isostatic state of the nearside mascon basins. These results should give an indication of the variability in strength of the lunar

lithosphere with time. Additionally, the origin of the gravity moats that surround most basins is being investigated. Particularly, we are attempting to discern whether these gravity lows are caused by (1) thickened crust due to the excavation flow during crater formation, (2) low-density ejecta, or (3) brecciated in situ bedrock. If it can be shown that either (2) or (3) is the most likely cause, estimates of the ejecta thickness or "strength crater" diameter may be able to be obtained. (Additional information is contained in the original.)
Author
Gravitational Fields; Lunar Gravitation; Lunar Maria; Topography; Lunar Craters; Meteorite Craters; Selenology; Lunar Crust; Mathematical Models

20000031610 NASA Kennedy Space Center, Cocoa Beach, FL USA
Magellan Press Conference (2 of 2)
Oct. 29, 1991; In English; Videotape: 23 min. 28 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000036566; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

Live footage shows the speakers participating in the Magellan Press Conference question and answer session. Speakers include Huntress, Spear, Ledbetter, Johnson, McCarthy, and Saunders. The speakers are shown answering questions from various NASA Centers, and participating audience members from many different industries. They discuss the start and stop date for the mapping. Also shown are animation and radar images of Venus and Artemis. This is tape 2 of 2; tape 1 has a report number NONP-NASA-VT-2000036552.
CASI
Conferences; Magellan Project (NASA); Space Exploration; Venus Surface

20000031611 NASA Kennedy Space Center, Cocoa Beach, FL USA
Magellan Press Conference (1 of 2)
Aug. 09, 1990; In English; Videotape: 1 hr. 2 min. 31 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000036552; No Copyright; Avail: CASI; B04, Videotape-Beta; V04, Videotape-VHS

Live footage shows several speakers participating in the Magellan Press Conference. Speakers include the Director of Solar System Exploration Division West Huntress, Magellan Project Manager Tony Spear, Spacecraft Team Chief W. Ledbetter, Radar System Chief Engineer T. Johnson, and Magellan Project Manager from Hughes Aircraft Co. T. McCarthy. The speakers discuss the Venus Orbiting Insertion (VOI), radar system components, spacecraft development, mission objectives, and the flight plans. This is tape 1 of 2; tape 2 has a report number NONP-NASA-VT-2000036566.
CASI
Conferences; Magellan Project (NASA); Magellan Spacecraft (NASA); Venus Orbiting Imaging Radar (Spacecraft); Space Exploration; Venus (Planet)

20000031622 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Galileo - Ganymede Family Night
Jun. 26, 1996; In English; Videotape: 1 hr. 30 min. playing time, in color, with sound
Report No.(s): AVC-1996-199; NONP-NASA-VT-2000036029; No Copyright; Avail: CASI; B04, Videotape-Beta; V04, Videotape-VHS

When the Galileo spacecraft flew by Ganymede, Jupiter's and the solar system's largest satellite, on June 26, 1996, the project scientists and engineers gather with their friends and family to view the photos as they are received and to celebrate the mission. This videotape presents that meeting. Representatives from the various instrument science teams discuss many of the instruments aboard Galileo and show videos and pictures of what they have seen so far. This video is continued on Videotape number NONP-NASA-VT-2000036028.
CASI
Galileo Spacecraft; Ganymede; Jupiter (Planet); Galilean Satellites; Jupiter Red Spot; Jupiter Satellites

20000031623 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Galileo - Ganymede Family Night
Jun. 26, 1996; In English; Videotape: 27 min. playing time, in color, with sound
Report No.(s): AVC-1996-199; NONP-NASA-VT-2000036028; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

This videotape is a continuation of tape number NONP-NASA-VT-2000036029. When the Galileo spacecraft flew by Ganymede, Jupiter's and the solar system's largest satellite, the project scientist and engineers gather together with their friends

and family to view the photos as they are received. This videotape presents the last part of that meeting, which culminates in the announcement of the confirmation of the fly-by, and a review of the current trajectory status.
CASI
Galileo Spacecraft; Ganymede; Jupiter (Planet)

92
SOLAR PHYSICS

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

20000031762 Academia Sinica, Yunnan Observatory, Kunming, China
A Great Radio Burst with Abundant Fast Fine-Structures
Wang, Min, Academia Sinica, China; Xie, Rui-Xiang, Academia Sinica, China; Publications of the Yunnan Observatory; 1996; ISSN 1001-7526, No. 4, pp. 36-42; In Chinese; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A great solar radio burst was observed by the four-band high-time resolution synchronous observation system in Yunnan Obs. on July 30, 1990. In this burst, abundant ms-spikes were observed at 1. 42 GHz, 2. 00 GHz and 2.84 GHz respectively. The statistical distributions of the lifetimes and intensities of this ms-spikes are presented in this paper. The characteristics of this ms-spikes are also discussed.
Author
Solar Radio Bursts; Fine Structure; Solar Physics

20000031763 Academia Sinica, Yunnan Observatory, Kunming, China
Discrimination for the Real and False Signals on Solar Radio Fast Activity
Xie, Rui-Xiang, Academia Sinica, China; Wang, Min, Academia Sinica, China; Publications of the Yunnan Observatory; 1996; ISSN 1001-7526, No. 4, pp. 27-35; In Chinese; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Several types of radio interference samples and Solar radio fast signal confirmed from solar radio telescopes with four band observations at Yunnan Observatory are presented in this paper. The discrimination of real and false signals is approached based on the quite similarity between the solar radio radiation and radio interference signal.
Author
Solar Physics; Radio Signals; Solar Activity

20000031764 Academia Sinica, Yunnan Observatory, Kunming, China
Effect of Large Sunspot Group on Solar Total Irradiance
Li, Zhi-Kai, Academia Sinica, China; Wu, Ming-Chan, Academia Sinica, China; Luan, Di, Academia Sinica, China; Publications of the Yunnan Observatory; 1996; ISSN 1001-7526, No. 4, pp. 21-26; In Chinese; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

In the paper the correlation coefficient between the solar total irradiance and various kinds of projected areas of sunspots, the projected area of umbra of large sunspot group, the projected area of large sunspot group, the projected area of all the sunspots on the disk per day are calculated respectively by means of the data from the large sunspot groups photographed with 26 cm Vacuum Solar Telescope, the data from the sunspot groups drawn at the Yunnan Observatory and the solar total irradiance measured by the radiator on Nimbus 7 during the period of the 22nd solar maximum years. As a result these correlation coefficients successively are r(sub 1) = -0.89, r(2) = -0.77, r(sub 3) = -0.59. The brief explanation is given to these results and the other relevant result is also discussed.
Author
Sunspots; Solar Activity Effects; Irradiance; Solar Physics

93
SPACE RADIATION

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

20000028417 NASA Goddard Inst. for Space Studies, New York, NY USA
Six Years of Short-Spaced Monitoring of the v=1 and v=2 J=1-0 (28)SiO Maser Emission in Evolved Stars
Alcolea, J., Observatorio Astronomico Nacional, Spain; Pardo, J. R., NASA Goddard Inst. for Space Studies, USA; Bujarrabal, V., Observatorio Astronomico Nacional, Spain; Bachiller, R., Observatorio Astronomico Nacional, Spain; Barcia, A., Observatorio Astronomico Nacional, Spain; Colomer, F., Observatorio Astronomico Nacional, Spain; Gallego, J. D., Observatorio Astronomico Nacional, Spain; Gomez-Gonzalez, J., Observatorio Astronomico Nacional, Spain; delPino, A., Observatorio Astronomico Nacional, Spain; Planesas, P., Observatorio Astronomico Nacional, Spain; Astronomy and Astrophysics; [1999], pp. 1-32; In English; Sponsored in part by the Spanish DGES
Contract(s)/Grant(s): PB96-0104; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present the results from a monitoring of the v=1 and v=2 J=1-0 (28)SiO maser emission in 21 objects, covering all types of known SiO maser emitters: 13 Mira variables, 2 long period semiregulars (SRGs), 3 variable supergiants (SGs), 2 OH/IR stars, and one young stellar object. This study has been carried out with the 13.7 meter radiotelescope of the Centro Astronomico de Yebes (Guadalajara, Spain), from July 1984 to May 1990, and represents the longest and most tightly sampled monitoring of SiO masers ever published. Our data show that for Mira-type (i.e. regular) variables, the SiO and optical light curves agree in period, and that the maxima of the SiO emission lag the optical ones by about 0.1-0.2 periods. Since a similar lag characterizes the near infrared (NIR) emission variability from these stars, we conclude that for regular variables SiO and NIR vary in phase. This result was confirmed in three objects for which NIR variability curves are available. For SRGs and SGs, we found a less systematic behavior, but when the SiO emission is periodic, its variability curve agrees with the optical one, also showing a lag between maximum epochs similar to that of Mira-type stars. The data clearly reveal other interesting details on the SiO maser variability, such as the strong intensity differences between different maxima and changes in the velocity distribution of the emission. Finally, the SiO masers associated to the young stellar object Orion IRc2 showed a double peaked spectrum with low amplitude, aperiodic variations.
Author
Masers; Spectral Emission; Silicon Oxides; Star Formation

20000030688 NASA Kennedy Space Center, Cocoa Beach, FL USA
STS-37 Gamma Ray Observatory Arrival and VPF Activities
Feb. 09, 1991; In English; Videotape: 28 min. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-2000013435; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

Live footage shows the STS-37 Gamma Ray Observatory, its move to the airlock, the removal of its plastic covering, and its lift to the work-stand.
CASI
Gamma Ray Observatory; Gamma Ray Telescopes; Gamma Ray Astronomy; Spaceborne Astronomy; Air Locks

20000030693 National Optical Astronomy Observatories, Tucson, AZ USA
The Dynamics and Light Curves of Beamed Gamma Ray Burst Afterglows
Rhoads, James E., Kitt Peak National Observatory, USA; July 1999; 24p; In English
Report No.(s): NOAO-Preprint-848; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The energy requirements of gamma ray bursts have in past been poorly constrained because of three major uncertainties: The distances to bursts, the degree of burst beaming, and the efficiency of gamma ray production. The first of these has been resolved, with both indirect evidence (the distribution of bursts in flux and position) and direct evidence (redshifted absorption features in the after-low spectrum of GRB 970508) pointing to cosmological distances. We now wish to address the second uncertainty. Afterglows allow a statistical test of beaming, described in an earlier paper. In this paper, we modify a standard fireball afterglow model to explore the effects of beaming on burst remnant dynamics and after,low emission. If the burst ejecta are beamed into angle zeta(sub m), the burst remnant's evolution changes qualitatively once its bulk Lorentz factor Gamma approx. less than 1/zeta(sub m): Before this, Gamma declines as a power law of radius, while afterwards, it declines exponentially. This change results in a broken power law light curve whose late-time decay is faster than expected for a purely spherical geometry. These predictions disagree with afterglow observations of GRB 970508. We explored several variations on our model, but none seems able to change this result. We therefore suggest that this burst is unlikely to have been highly beamed, and that its energy

requirements were near those of isotropic models, More recent afterglows may offer the first practical applications for our beamed models.
Author
Gamma Ray Bursts; Afterglows; Light Curve; Energy Requirements; Dynamic Characteristics

20000030728 Nobeyama Radio Observatory, Nobeyama, Japan
High Resolution VSOP Imaging of a Southern Blazar PKS 1921-293 at 1.6 GHz
Shen, Z.-Q., National Astronomical Observatory, Japan; Edwards, P. G., Tokyo Univ., Japan; Lovell, J. E. J., Tokyo Univ., Japan; Fujisawa, K., Nobeyama Radio Observatory, Japan; Kameno, S., Nobeyama Radio Observatory, Japan; Inoue, M., Nobeyama Radio Observatory, Japan; 1999; ISSN 0911-5501; 18p; In English; Sponsored in part from the Michigan Univ.
Report No.(s): NRO-503; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present a high resolution 1.6 GHz VSOP (VLBI Space Observatory Program) image of the southern blazar PKS 1921-293. The image shows a typical core-jet morphology, consistent with ground-based VLBI (Very Long Base Interferometry) images. However, the addition of data from the space antenna has greatly improved the angular resolution (especially along the north-south direction for this source), and thus allowed us to clearly identify the core. Model fitting reveals an inner jet component approx, 1.5 mas north of the core. This jet feature may be moving on a common curved path connecting the jet within 1-2 h (exp-1) pc to the 10 pc-scale jet. The compact core has a brightness temperature of 2.6 x 10 (exp 12) K (in the rest frame of the quasar), an indication of relativistic beaming. We analyzed the source in terms of three models, involving the inverse Compton catastrophe, an inhomogeneous relativistic jet, and the equipartition of energy between the radiating particles and the magnetic field. Our analysis of this gamma-ray-quiet blazar shows no preference to any particular one of these models.
Author
Very Long Base Interferometry; High Resolution; Space Observations (From Earth); Blazars; Imaging Techniques

20000030733 Nobeyama Radio Observatory, Nobeyama, Japan
The Enormous Outburst of the 7.9 km s-1 Water-Maser Feature in Orion KL
Omodaka, Toshihiro, Kagoshima Univ., Japan; Maeda, Toshihisa, Kagoshima Univ., Japan; Miyoshi, Makoto, National Astronomical Observatory, Japan; Okudaira, Atuya, Kagoshima Univ., Japan; Nishio, Masanori, Kagoshima Univ., Japan; Miyaji, Takeshi, National Astronomical Observatory, Japan; Motiduki, Nanako, National Astronomical Observatory, Japan; Morimoto, Masaki, Nishi-Harima Astronomical Observatory, Japan; Kobayashi, Hideyuki, Tokyo Univ., Japan; Sasao, Tetsuo, National Astronomical Observatory, Japan; Publication of Astronomical Society; 1999; ISSN 0911-5501; Volume 51, pp. 333-336; In English
Contract(s)/Grant(s): MOESSC-10640232
Report No.(s): NRO-504; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We report on a spectacular flare in the water-vapor maser emission from the KL nebula, which we found in 1997 December. The flare, at a velocity of 7.9 km per second, continued to increase in intensity exponentially and had a flux density greater than 3.5 x 10 (exp 6) jy. The central velocity of the flare component was 7.9 km per second and the line width was less than 40 kHz. We did not detect a ”rapid” time variation in the intensity. The flare component is currently increasing steadily. A preliminary VLBI (Very Long Base Interferometry) observation was made using a Japanese domestic VLBI network, called J-Net, in order to determine the location of the flare. Its position is alpha = 05 (sup h) 32 (sup m) 46 (sup s).6, delta = -5 deg. 24’27.”2(1950.0) plus or minus 1”. In this region, strong outbursts were reported during the period from 1979 August to 1985 November. Both the central velocity and the position of the present flare seems to be the same as that of previous ones. This suggests a common origin of these phenomena.
Author
Water Masers; Orion Nebula; Very Long Base Interferometry; Stellar Flares

20000031890 NASA Langley Research Center, Hampton, VA USA
An Improved Neutron Transport Algorithm for Space Radiation
Heinbockel, John H., Old Dominion Univ., USA; Clowdsley, Martha S., Old Dominion Univ., USA; Wilson, John W., NASA Langley Research Center, USA; March 2000; 36p; In English
Contract(s)/Grant(s): RTOP 101-15-01-51
Report No.(s): NASA/TP-2000-209865; NAS 1.60:209865; L-17876; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A low-energy neutron transport algorithm for use in space radiation protection is developed. The algorithm is based upon a multigroup analysis of the straight-ahead Boltzmann equation by using a mean value theorem for integrals. This analysis is

accomplished by solving a realistic but simplified neutron transport test problem. The test problem is analyzed by using numerical and analytical procedures to obtain an accurate solution within specified error bounds. Results from the test problem are then used for determining mean values associated with rescattering terms that are associated with a multigroup solution of the straight-ahead Boltzmann equation. The algorithm is then coupled to the Langley HZETRN code through the evaporation source term. Evaluation of the neutron fluence generated by the solar particle event of February 23, 1956, for a water and an aluminum-water shield-target configuration is then compared with LAHET and MCNPX Monte Carlo code calculations for the same shield-target configuration. The algorithm developed showed a great improvement in results over the unmodified HZETRN solution. In addition, a two-directional solution of the evaporation source showed even further improvement of the fluence near the front of the water target where diffusion from the front surface is important.
Author
Neutrons; Algorithms; Radiation Protection; Mathematical Models; Applications Programs (Computers); Extraterrestrial Radiation

99
GENERAL

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

20000029550 NASA, Washington, DC USA
NASA Historical Data Book, Volume 5, NASA Launch Systems, Space Transportation, Human Spaceflight and Space Science, 1979-1988
Rumerman, Judy A., NASA, USA; 1999; 550p; In English
Report No.(s): NASA/SP-1999-4012/VOL5; NAS 1.21:4012/VOL5; -; ISSN 0-16-050030-3; No Copyright; Avail: CASI; A23, Hardcopy; A04, Microfiche

In 1973, NASA published the first volume of the NASA Historical Data Book, a hefty tome containing mostly tabular data on the resources of the space agency between 1958 and 1968. There, broken into detailed tables, were the facts and figures associated with the budget, facilities, procurement, installations, and personnel of NASA during that formative decade. In 1988, NASA reissued that first volume of the data book and added two additional volumes on the agency's programs and projects, one each for 1958-1968 and 1969-1978. NASA published a fourth volume in 1994 that addressed NASA resources for the period between 1969 and 1978. This fifth volume of the NASA Historical Data Book is a continuation of those earlier efforts. This fundamental reference tool presents information, much of it statistical, documenting the development of four critical areas of NASA responsibility for the period between 1979 and 1988. This volume includes detailed information on the development and operation of launch systems, space transportation, human spaceflight, and space science during this era. As such, it contains in-depth statistical information about the early Space Shuttle program through the return to flight in 1988, the early efforts to build a space station, the development of new launch systems, and the launching of seventeen space science missions.
Author
Histories; Space Missions; Documentation; NASA Space Programs; Manned Space Flight; Launch Vehicles; Rocket Launchers; Aerospace Sciences

20000031366 NASA, Washington, DC USA
Power to Explore: A History of the Marshall Space Flight Center, 1960-1990
Dunar, Andrew J., NASA, USA; Waring, Stephen P., NASA, USA; 1999; 730p; In English
Report No.(s): NASA/1999-SP-4313; NAS 1.21:4313; LC-90-043539; ISBN 0-16-058992-4; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche

This scholarly study of NASA's Marshall Space Flight Center places the institution in social, political, scientific and technological context. It traces the evolution of Marshall, located in Huntsville, Alabama, from its origins as an Army missile development organization to its status in 1990 as one of the most diversified of NASA's field Center. Chapters discuss military rocketry programs in Germany and the USA, Apollo-Saturn, Skylab, Space shuttle, Spacelab, the Space Station, and various scientific and technical projects including the Hubble Space Telescope. It sheds light not only on the history of space technology, science and exploration, but also on the Cold War, federal politics and complex organizations.
Derived from text
Histories; Technologies; NASA Programs

Subject Term Index

A

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